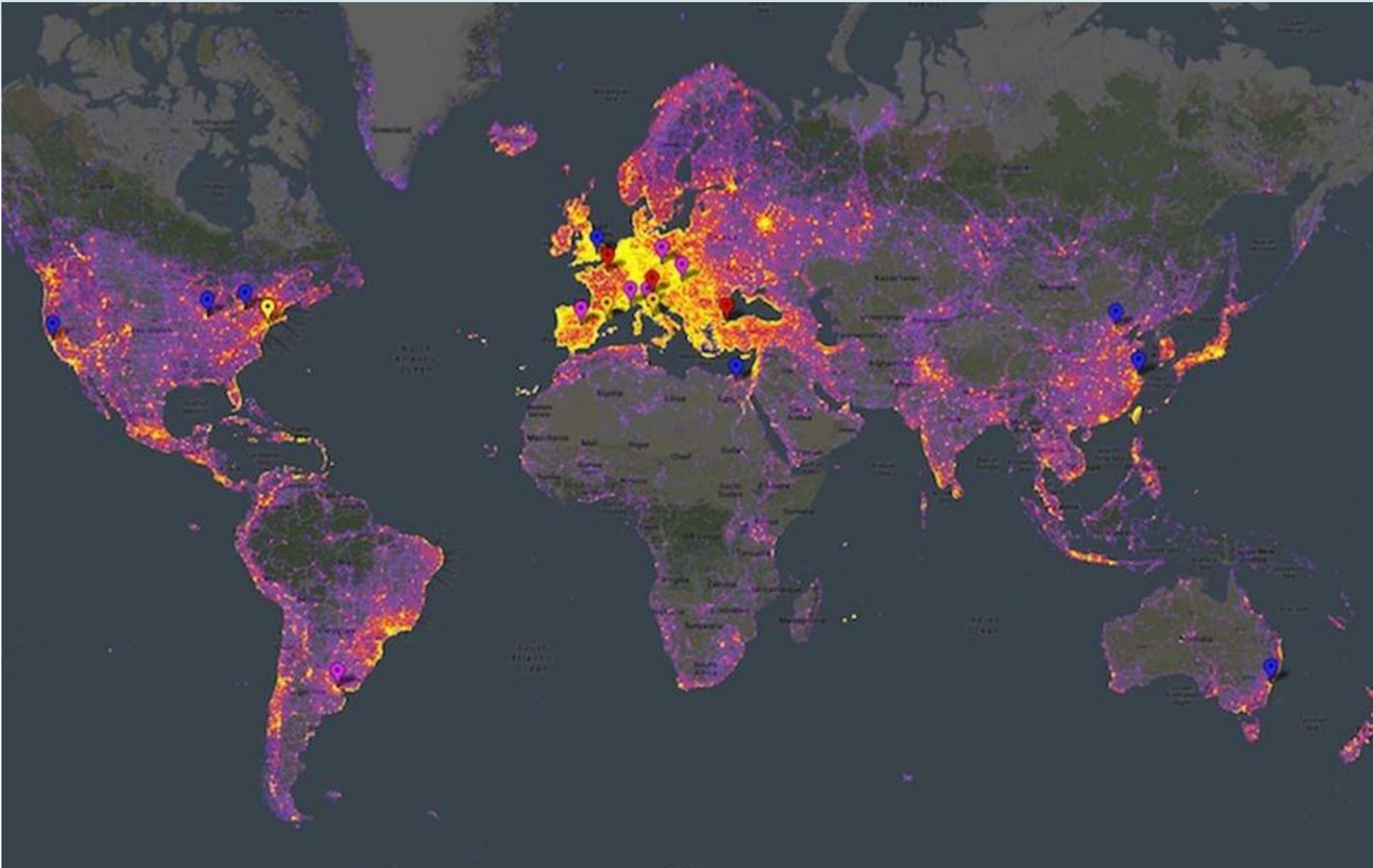
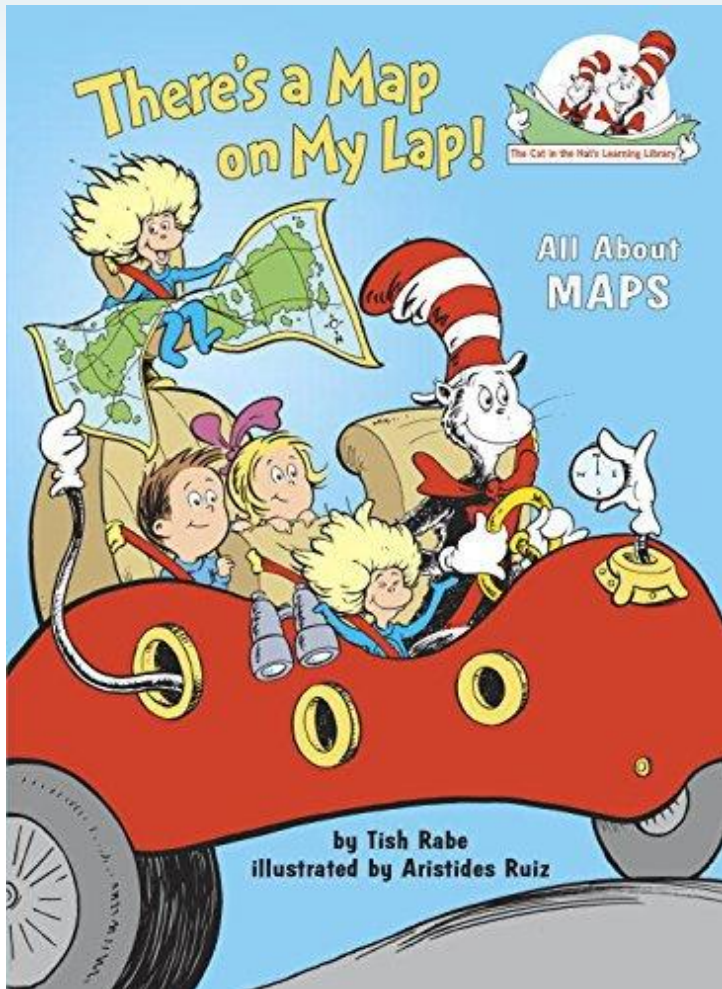


What is this a map of?



Using GIS, Maps, and Spatial Methods to Advance Child Care and Early Education Policy Analysis and Research



Erin Hardy, Brandeis University
Jennifer Rankin, HealthLandscape
Roberta Weber, Oregon State University

Facilitator:

Liz Davis, University of Minnesota

With funding support from HHS/ACF/OPRE
(Child Care Research Partnership Grant Program)

Erin Hardy, Brandeis University

MA Child Care Research Partnership | diversitydatakids.org



Agenda

- Where we are with GIS and spatial methods as a field?
- Where can we go with GIS and spatial methods as a field?
- Blue sky ideas

Where are we ?



Many of our “big” questions have a geographic footprint

Local
Access

Supply of
care

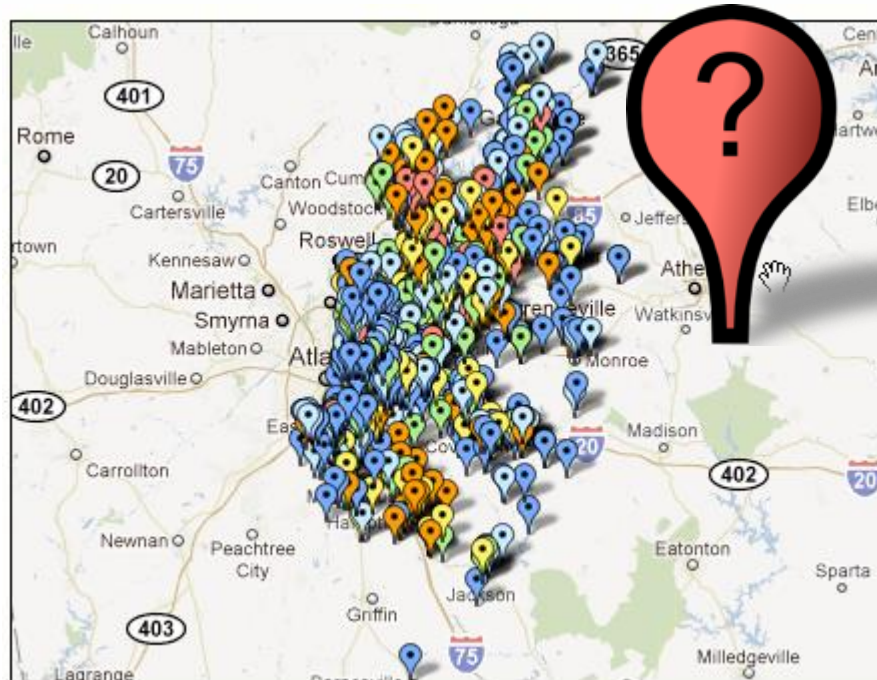
Provider
Quality

Subsidy
participation

Admin
practices

Use of
contracts

Pre-K
expansion



East Metro Atlanta Child Care Centers.

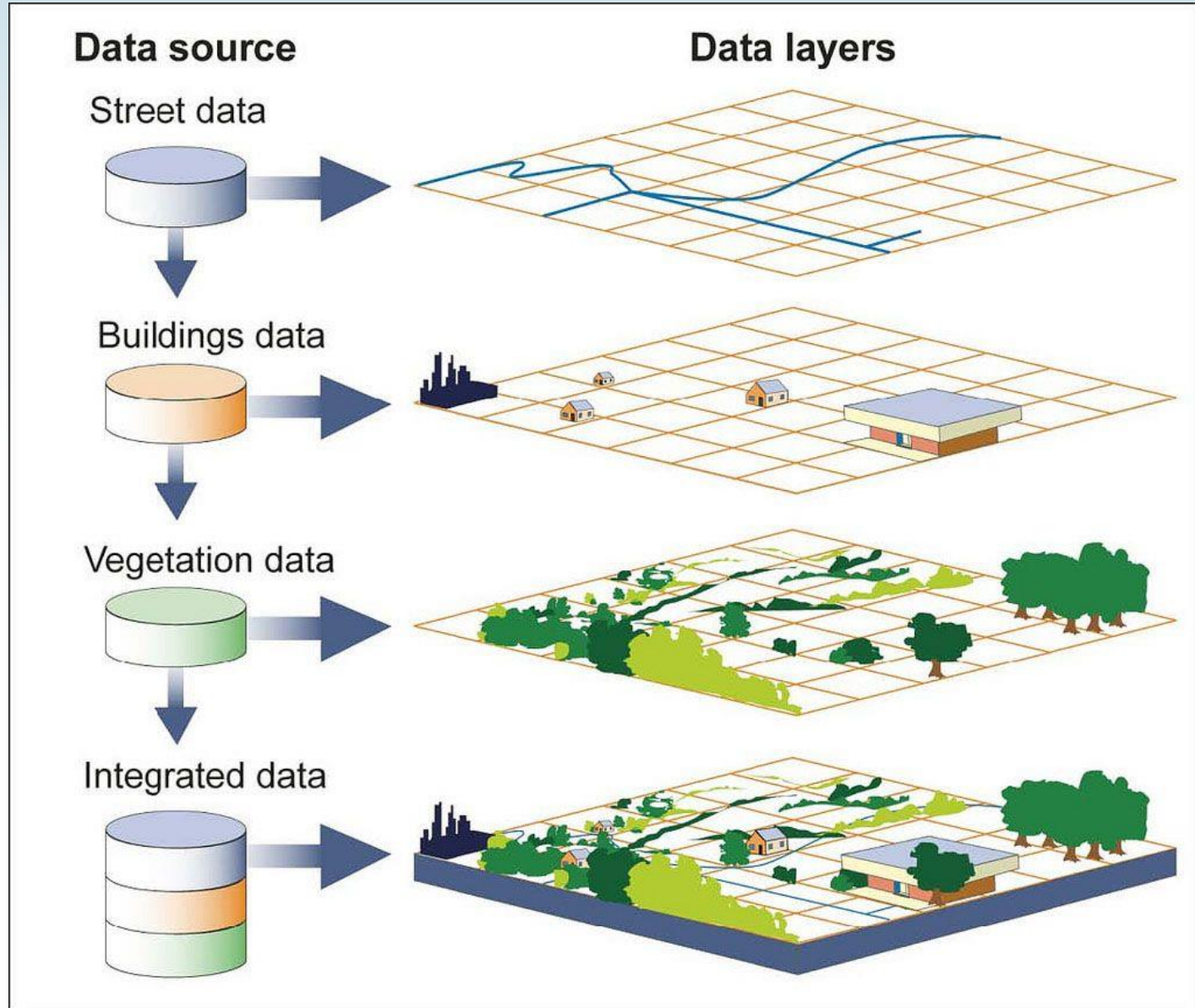
Some thoughts on where the field is...

MORE ACTIVE				LESS ACTIVE		
Sample projects	Locator maps	Thematic maps	Develop Measures	Data collection	ESDA	Spatial regression
MA CCRP	X	X	X		X	
OR-CCRP	X	X				
NY-IL CCRP	X	X	X			
MN STUDY	X	X	X			
NYC Supply/ Demand	X	X				
PA Risk/Reach	X	X				
DE	X	X				
IECAM	X	X*				
Childcaremap (Philadelphia)	X	X*				

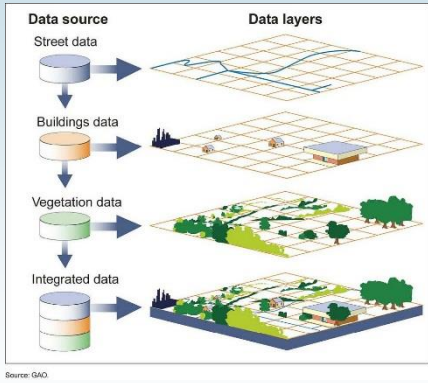
There are opportunities in both areas

*Interactive map tool

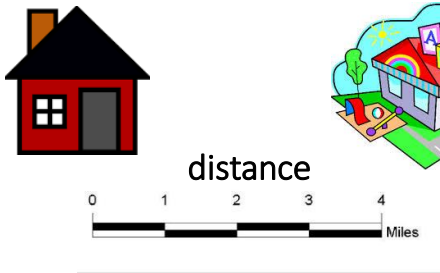
GIS: Geographic Information System



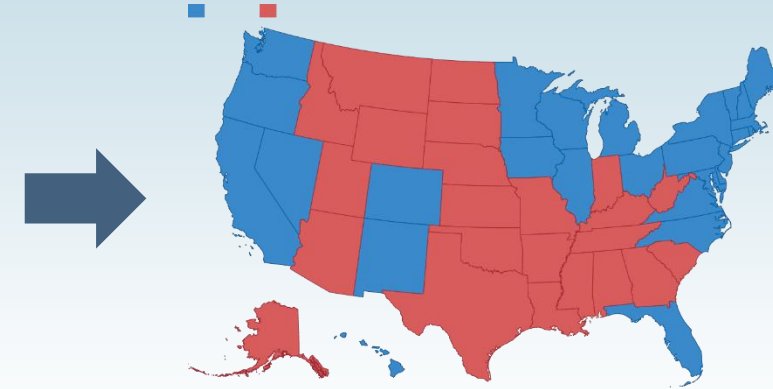
GIS, MAPS, SPATIAL METHODS



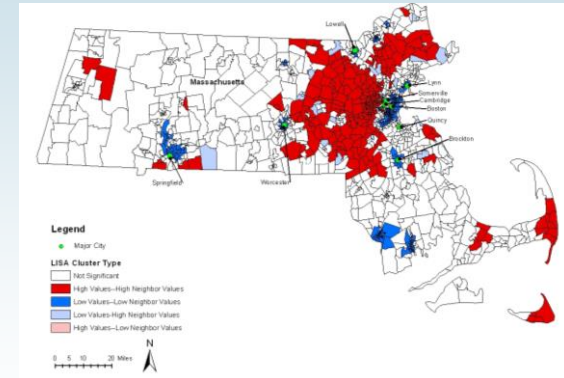
GIS



Measure development



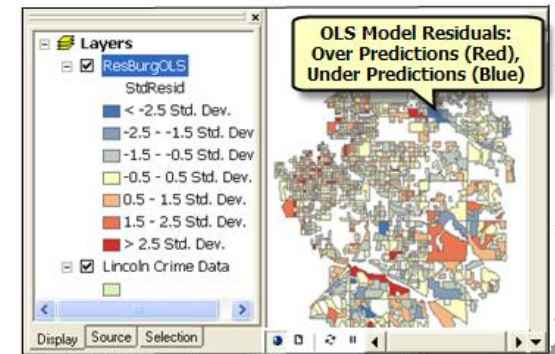
Thematic maps



Spatial analysis



Data collection



Spatial regression

The GIS/Spatial Methods “Menu”

Use	What for?	Examples
Locator maps	<ul style="list-style-type: none">To search for things (like ECE programs)	<ul style="list-style-type: none">Searchable online child care directories
Thematic maps	<ul style="list-style-type: none">To tell a data story	<ul style="list-style-type: none">Illinois Early Childhood Asset Map Demographic Theme Maps
Measure development	<ul style="list-style-type: none">Create new variables – e.g. neighborhood summary measures, distance measures	<ul style="list-style-type: none">Family travel distanceSubsidy usage by county
Data collection	<ul style="list-style-type: none">To collect data	<ul style="list-style-type: none">SSO iTour (Systematic Social Observation with Google Streetview)
Exploratory Spatial Data Analysis (ESDA)	<ul style="list-style-type: none">To understanding spatial arrangement and spatial autocorrelation	<ul style="list-style-type: none">Clustering/dispersionCrime analysis: Hotspot/densityMoran's I
Spatial regression	<ul style="list-style-type: none">To understanding spatial dependence	<ul style="list-style-type: none">Spatial error modelsSpatial lag models

Where could we go?



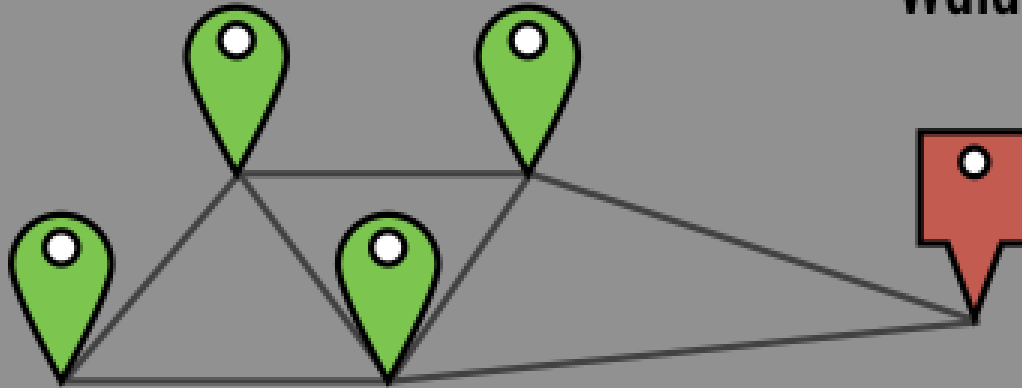
Overview of opportunities (in reverse order)

- “Newer” areas
 - Exploratory Spatial Data Analysis
 - Spatial Regression
 - Data Collection
- Areas where the field is already active
 - Measure development
 - Thematic maps

Opportunities in “newer areas”

Everything is related to
everything else, but near things
are more related than distant
things.

-Waldo Tobler



Tobler's First Law of Geography

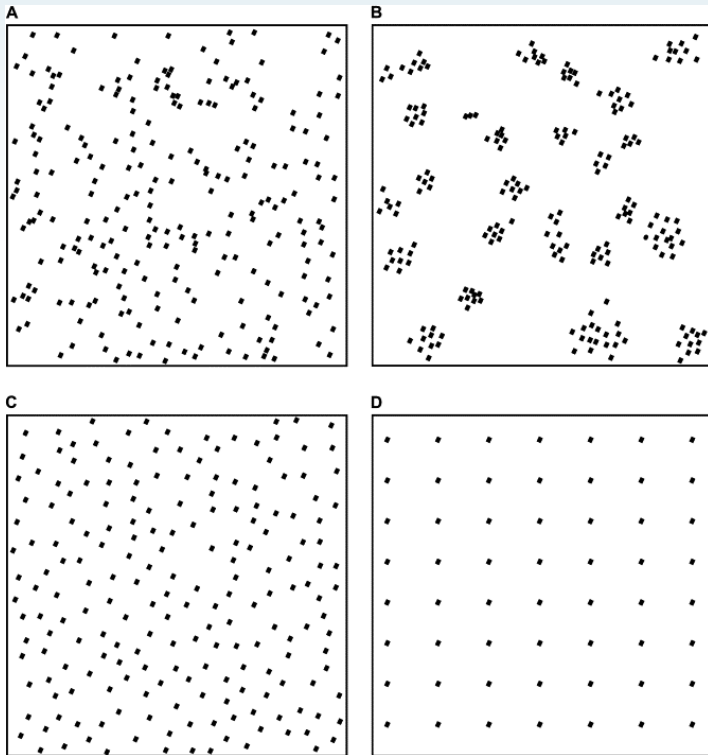
What is Exploratory Spatial Data Analysis?

- Collection of techniques to:
 - Describe and visualize spatial distributions
 - Discover patterns of spatial association
- Central concept: spatial autocorrelation
 - “Autocorrelation” = self correlation
 - Spatial autocorrelation = attribute is correlated with itself in space
 - Higher values at location A are associated with higher values at neighboring locations

ESDA is about: spatial association + attribute association

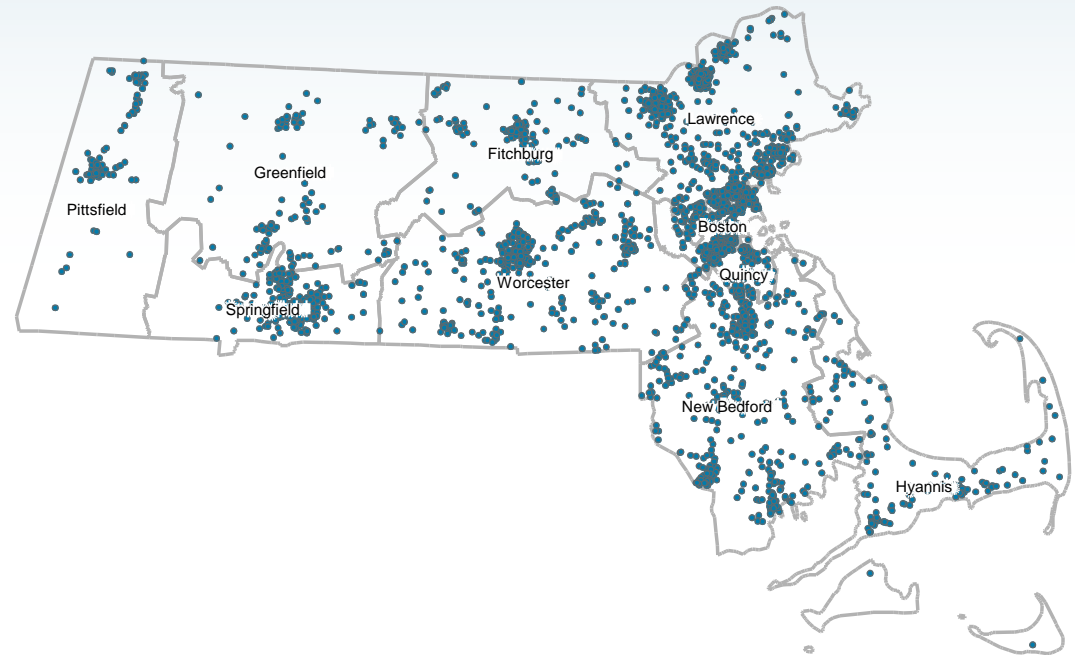
What is Exploratory Spatial Data Analysis?

Spatial arrangement
(Hypothetical)



Random? Clustered?
Uniform? Equidistant?

Spatial arrangement
(Empirical: MA Subsidy Providers)



Random? Clustered?
Uniform? Equidistant?

What is Exploratory Spatial Data Analysis?

Nearest Neighbor Ratio

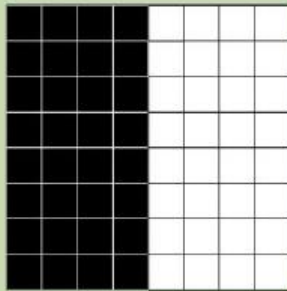


Spatial statistics help
us
formalize/summarize
the patterns we see
visually

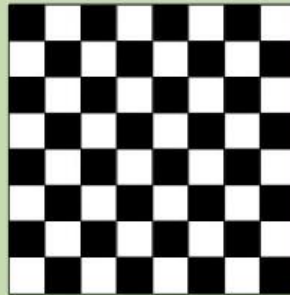
Closer to zero = more clustered

What is Exploratory Spatial Data Analysis?

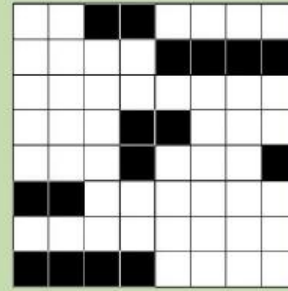
Spatial autocorrelation (Hypothetical)



Positive
Autocorrelation



Negative
Autocorrelation

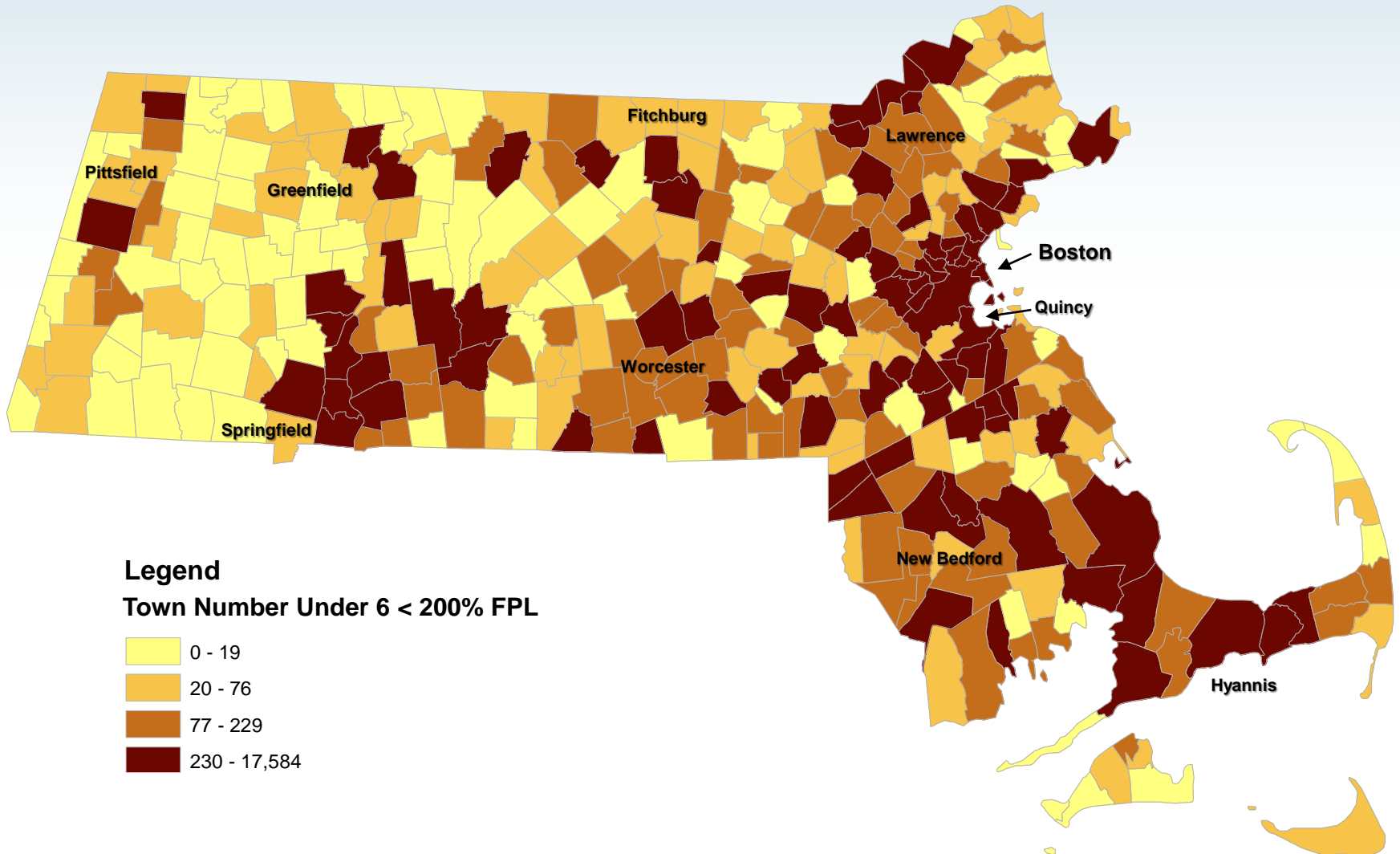


No Autocorrelation

(O'Sullivan and Unwin, 2002)

What is Exploratory Spatial Data Analysis?

Number of children under 6 < 200% Poverty (Town)



What is Exploratory Spatial Data Analysis?

Spatial Autocorrelation Report

Moran's Index: 0.115190

z-score: 4.196714

p-value: 0.000027

Significance Level
(p-value)

0.01

0.05

0.10

0.10

0.05

0.01

Critical Value
(z-score)

< -2.58

-2.58 ~ -1.96

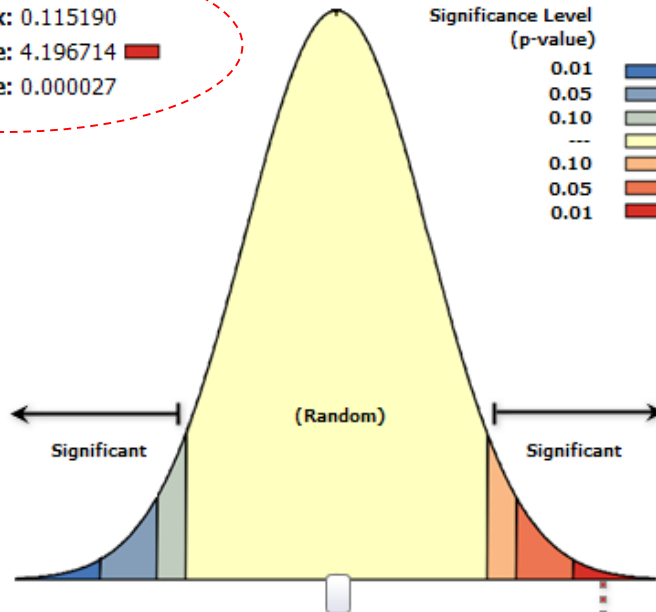
-1.96 ~ -1.65

-1.65 ~ 1.65

1.65 ~ 1.96

1.96 ~ 2.58

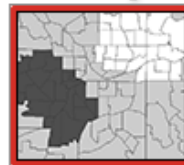
> 2.58



Dispersed



Random



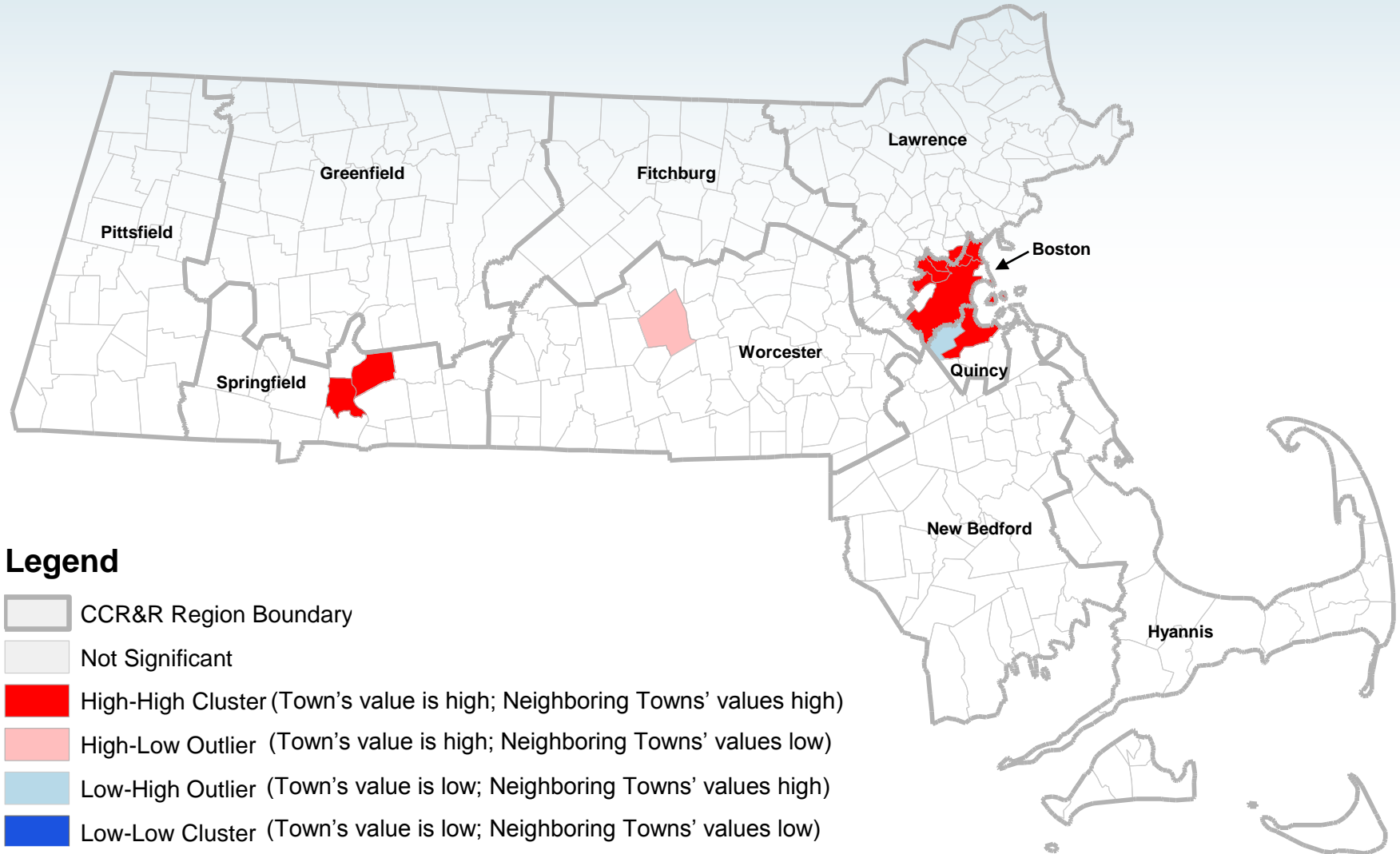
Clustered

Given the z-score of 4.20, there is a less than 1% likelihood that this clustered pattern could be the result of random chance.

Spatial statistics help us formalize the patterns we see visually

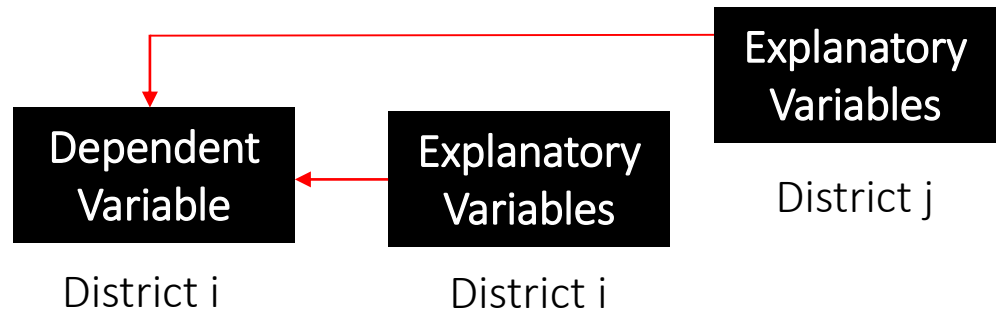
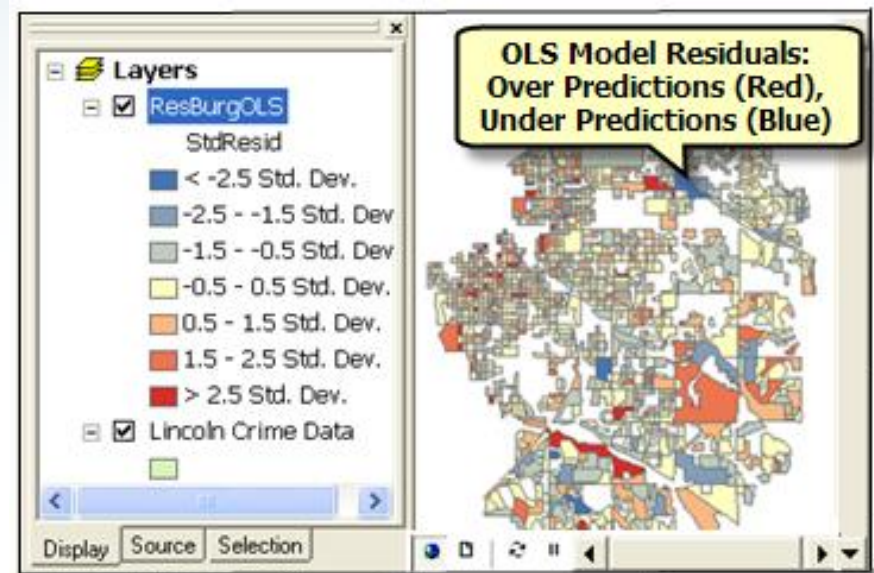
What is Exploratory Spatial Data Analysis?

Cluster Analysis (LISA=Local Indicators of Spatial Autocorrelation)



What is Spatial Regression?

- Spatial dependence: When a value observed in one district depends on the values observed in a neighboring district
- Why does spatial dependence happen?
 - Spatially-correlated measurement error
 - Spatial interaction or diffusion effects



Spatial Regression:

Types of questions we could explore

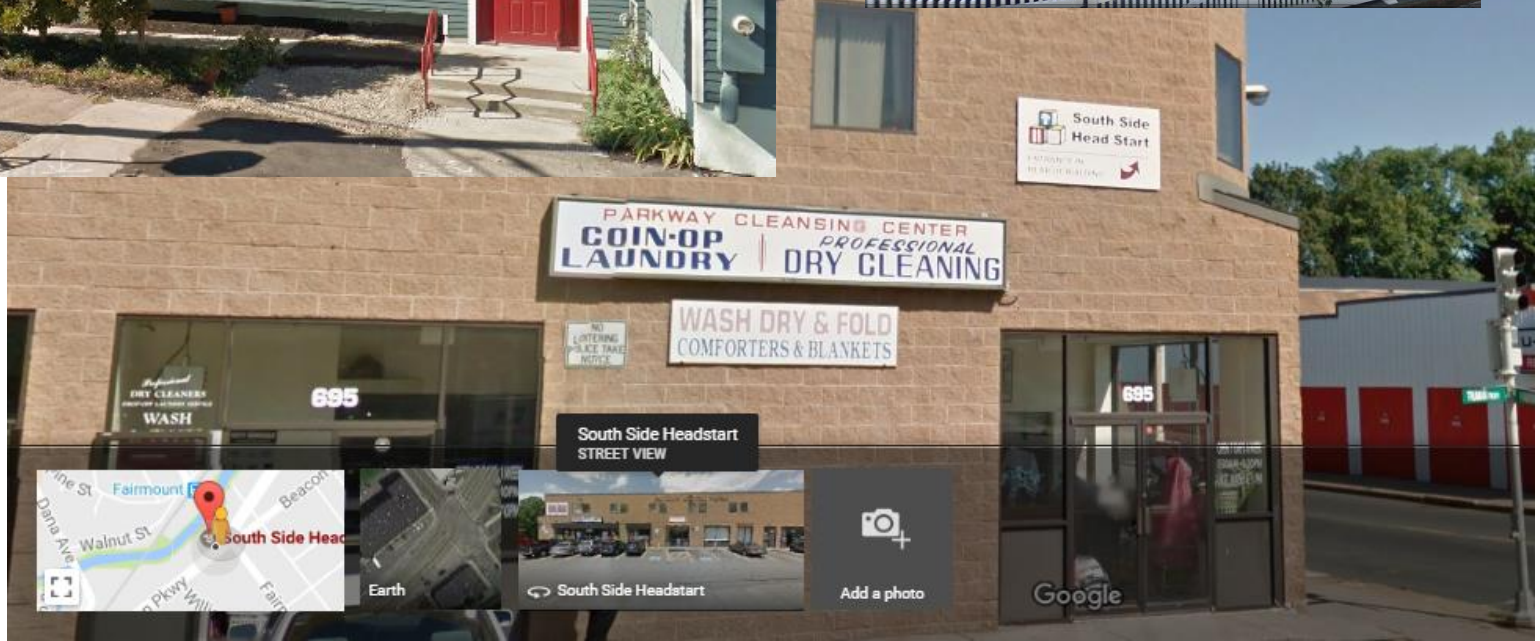
- Example 1: When high-quality providers locate in low SES neighborhoods, are those neighborhoods more likely to be in areas of concentrated disadvantage?
 - Small & Stark (2005) found that high-quality ECE centers in NYC more likely to be in poor neighborhoods
 - MA pilot study (Hardy, 2011) found when high-quality ECE centers in poor neighborhoods, more likely to be in areas of concentrated disadvantage
- Example 2: Do we observe spatial “spillover” effects in provider quality?
 - Cordes (2016) looked at spillover of charters on public schools

ESDA/Spatial Regression Opportunities

- **Geography of quality**
 - Where are the high quality centers located?
 - Are high quality programs locating in “high need” areas?
 - Provocative findings from Small & Stark 2005
 - MA/OH pilot study in 2011 suggests policy matters
- **Geography of need / service burden**
 - Attention to urban, suburban, and rural contexts
 - Child care “deserts” work grounded in access framework (e.g. walking distances)
- **Local usage and transportation-related studies**
 - How are people getting to care (foot, car, public transit)?

Data Collection Opportunities

- Use GIS-based tools to facilitate data collection as part of QRIS validation studies?



Opportunities in “existing areas”
(where we are already more active)

Measure development

- Do more of what we're doing:
 - Spatializing admin data
 - Linking admin to other data sources
 - Advancements in distance/travel time measures (MN)
 - Characteristics of supply/demand, risk/reach (IL-NY)
- National Survey of Early Care and Education linkages
 - PSU=county; SSU=census tract
 - 755 “provider clusters” – census tracts that overlap 2-mile radius of anchor (SSU) tract
 - Opportunities to combine NSECE data in provider clusters with other data sources at census tract level (Need level 2 or level 3 data access)
 - Explore geography coverage of counties – metro area estimates?

Thematic mapping

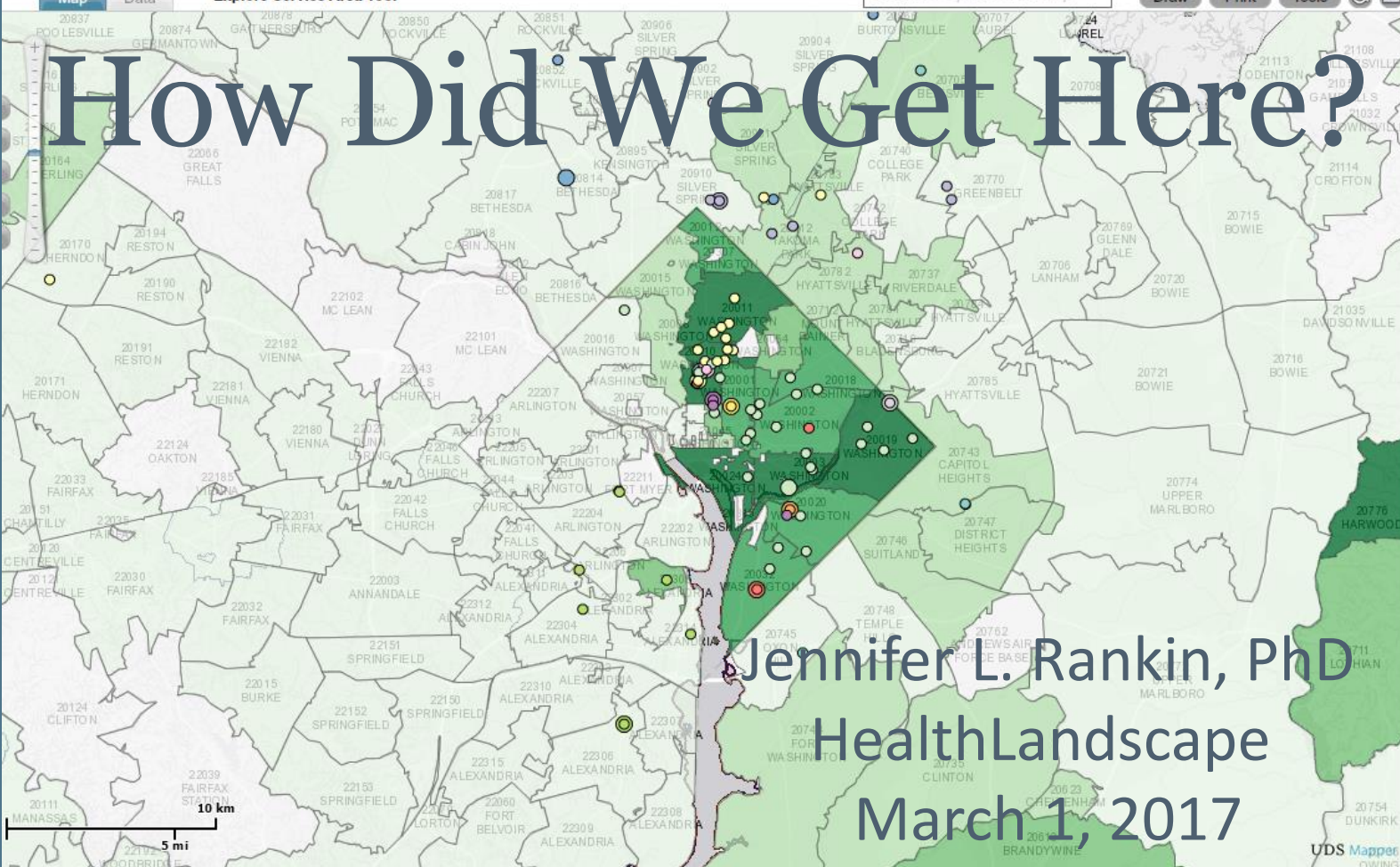
- Continue:
 - Using maps to communicate
 - Using maps as motivators
 - Making maps that state agencies need
- Share lessons about audience, users ?
- Dynamic vs. static thematic maps ?
- Warehouse/user customizability vs. “scaffolded” user experience
- Open-source / lower-cost tools
 - ESRI Storymaps; ArcGIS Online
 - Carto.com

Cautions

- Fit use to purpose: not everything is spatial
- Look before you leap: Investment / learning curve can be steep: consider audience, purpose for GIS/spatial work
- Self-teaching GIS/spatial analysis doesn't seem to be a "thing"
- Cartography counts – color theory; symbology matter
- Units: ZIP Codes aren't neighborhoods (usually), counties only matter sometimes, etc...

Blue sky ideas

- Federally-sponsored tool that supports state planning, research and evaluation efforts that primarily estimate CCDF and Head Start service need/burden at local level (parallel to HRSA tool)
 - Consistent approaches for estimating eligible populations; potential for linking to state admin data at community level
- Child Care and Early Education GIS Training Institute
 - Project-based; Modeled after Harvard CGA
- Website for mapping/spatial “products” to create a “menu” of products for state agencies and other decision makers to choose from



Jennifer L. Rankin, PhD
HealthLandscape
March 1, 2017

Select a mode to explore your area of interest; enter places of interest to zoom to or select an area. Check the boxes below to add health care facilities to the map.

Explore Service Area

- ☒ by Geography
- ☐ by Patient Origin
- ☐ by Distance

Search to Go or Select:

ZIP Code, County, State or Health Center

Washington, D. C., District of C

Go Add

Selected ZCTAs:

Go to Selected Areas Clear Selected ZCTAs

Health Care Facilities

- | Health Care Facilities | Rollovers |
|--|-------------------------------------|
| <input checked="" type="checkbox"/> Health Center Administrative Locations | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> Health Center Service Access Points | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> NHSC Sites | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> Rural Health Clinics | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> Facility and Point HPSAs | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> Hospitals | <input checked="" type="checkbox"/> |

Main Maps

Basemaps and Optional Layers

Layer Controls

Login And Account Settings

About HealthLandscape

- HealthLandscape is a division of the American Academy of Family Physicians
- Team of six people spread from coast to coast
- Develop online mapping tools and perform research and data visualization on topics that range from health workforce to social determinants of health to clinical dashboarding

HealthLandscape Tools

- School Based Health Alliance Mapping Tool
 - <http://www.sbh4all.org/resources/mapping-tool/>
- Arizona First Things First
 - <http://datacenter.azftf.gov/>
- Halton, Canada Our Kids Network Data Portal
 - <http://www.ourkidsnetwork.ca/Public/DataPortal.html>
- 500 Cities Mapping Tool
 - http://www.healthlandscape.org/map_Project500Cities.cfm

For a more exhaustive list, visit www.healthlandscape.org

About the UDS Mapper

- Built on data from the Uniform Data System of the Health Center Program (HRSA/ BPHC)
- Free, online mapping tool
- Launched in 2010 to help visualize where need for federally funded health centers exists
- Updated every year with new UDS and demographic data
- So far, every year there have been functionality improvements based on user input and feedback

Uniform Data System

- Desiring a system to gather data to inform decision making, the agency that oversaw health centers in the 1970s created what was to become the Uniform Data System
- Launched in 1978 after gaining consensus with the health centers about what to measure
- All health centers must use an Electronic Health Record and all EHRs used by HCs must be capable of producing UDS data
- In 2005 to address their mutual interest in the redefinition of service areas, the UDS started collecting information about patient location

Why Build a Mapping Tool?

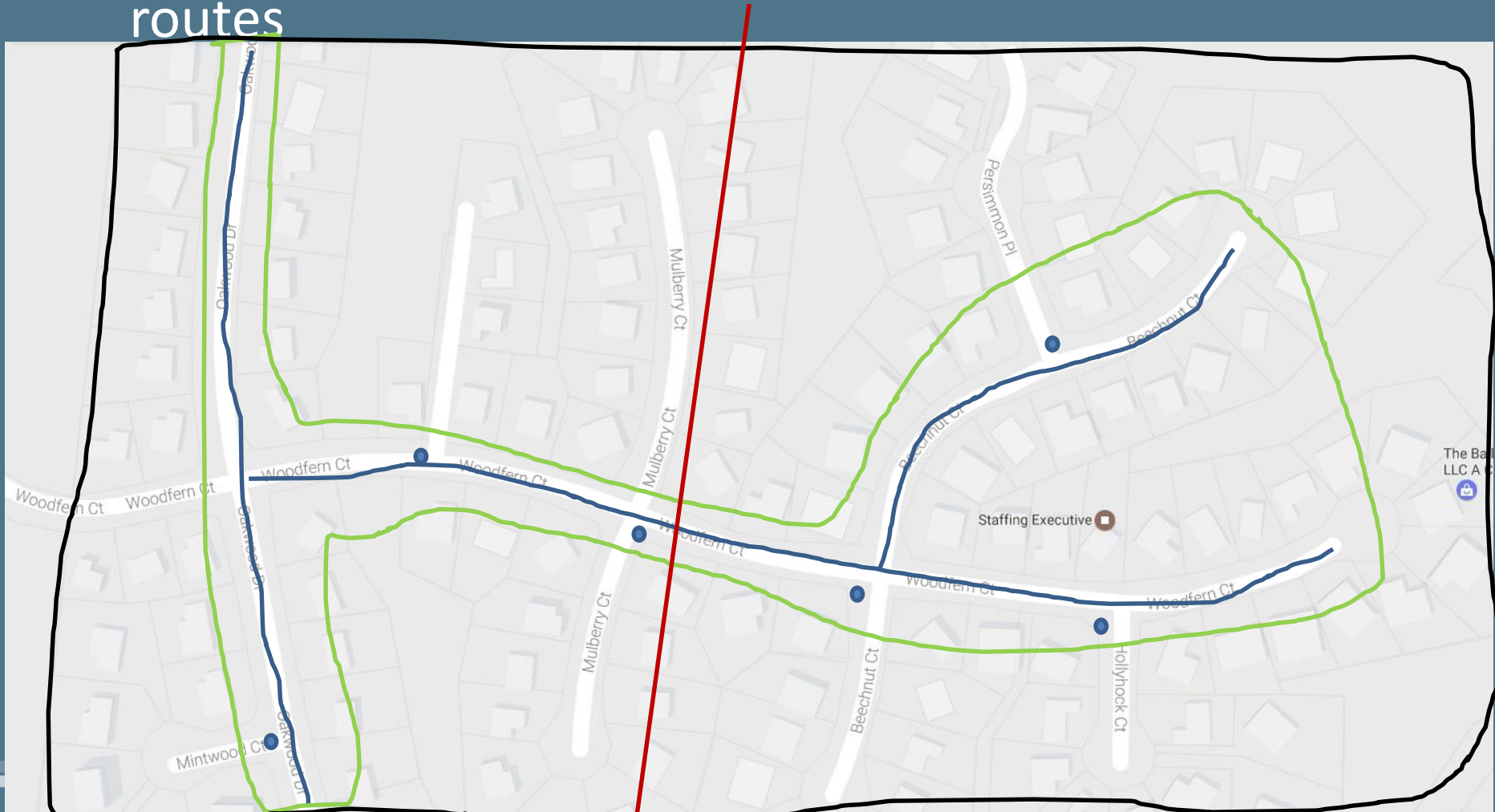
- Geography is important to the health center program
 - Must claim an area when seeking funding
 - Must serve a federally designated Medically Underserved Area or Population
 - Can access programs to help staff your health center if you are in a Health Professional Shortage Area
- Unit of geography is not uniform (census tracts, counties, minor civil divisions, Primary Care Service Areas)

Why Build a Mapping Tool?, cont.

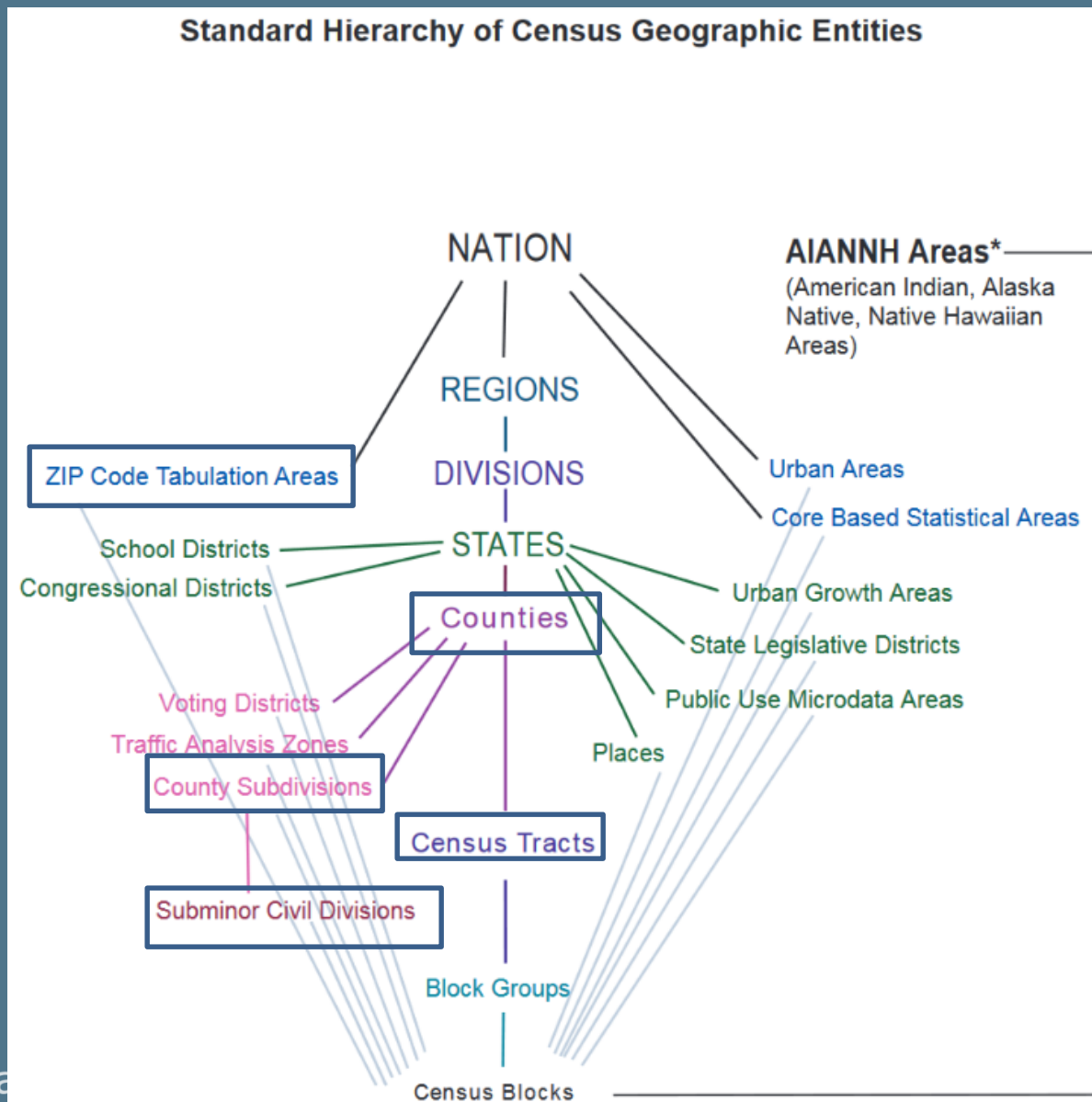
- Modeled after Community Oriented Primary Care concept
- Forbade, then tried to minimize service area overlap
- Worked with contractor to visualize potential overlap issues
 - This is why they started collecting patient origin data in 2005
 - Agreed to collect ZIP Code level data to minimize data reporting burden (easily taken from EHRs)

About ZIP Codes

- Not really an area but a collection of transportation routes



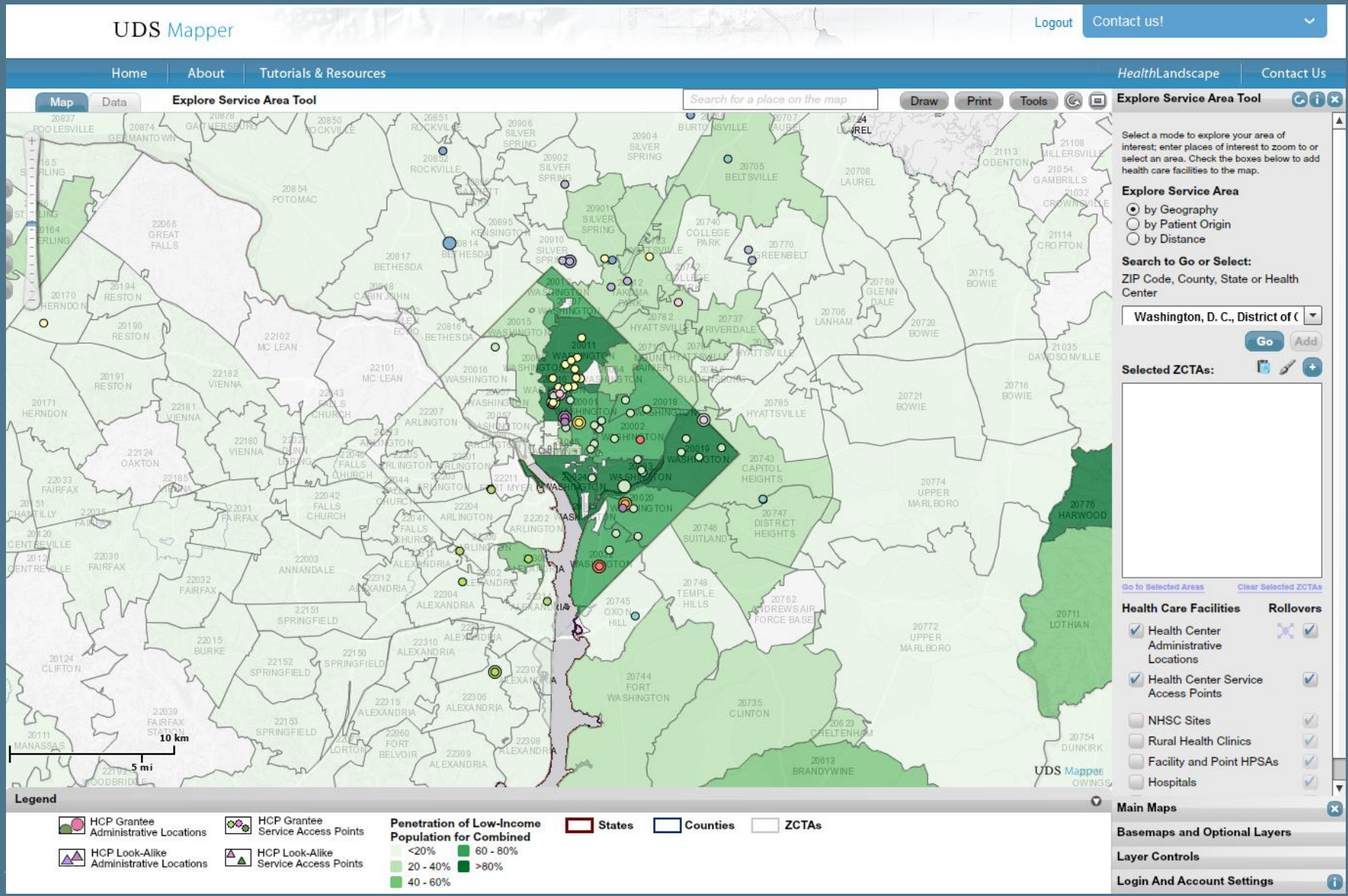
ZIP Code Tabulation Areas



Importance of Use Case

- UDS Mapper use case: Allow project officers to evaluate potential service area overlap
 - Guides development
 - Defines what tools and data are needed
 - Informs the data structure behind the tool
- But wait- there's more
 - 5 months into development, decided to open to the public
 - 5 months into a year-long development process, timeline was shortened to 9 months

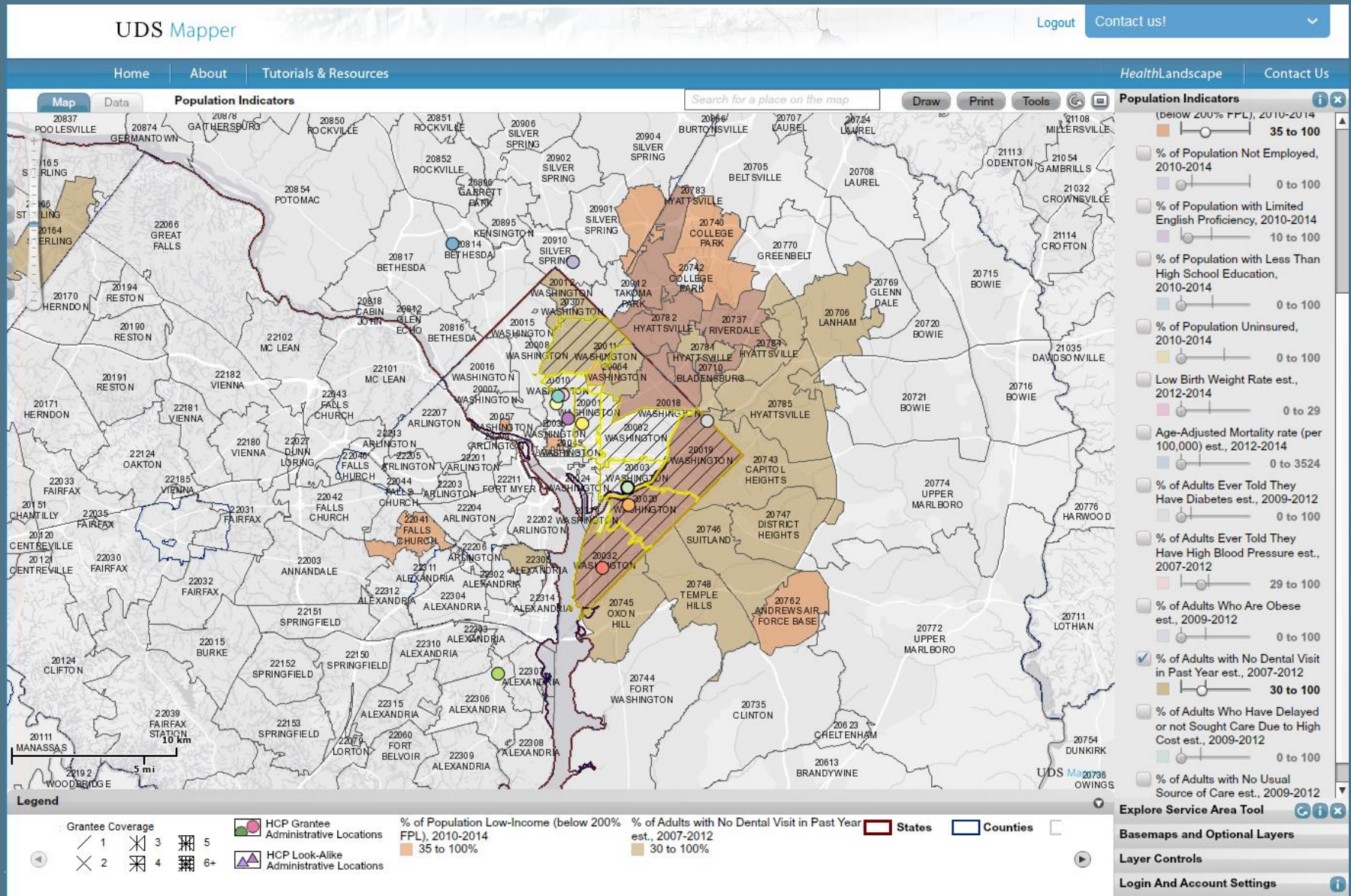
UDS Mapper: Initial Use Case



Evolving Use Case

- Compare patient use of health centers to demographic and population health indicators
 - Identify target population for comparison
 - Identify other relevant indicators
 - Why do the target users access these data?
 - How do the target users typically access these data?
 - What format do they need to report these data?
- New users = new data and new tools
- Not all users' needs can be accommodated in a single mapping tool

UDS Mapper: Evolved Use Case



Mapping Tool Now Influencing Program

- User freedom now limited
 - Must think in terms of ZIP Codes/ ZCTAs
 - Limited data at this geography
- Standard geography is not ideal
 - Too large to represent neighborhood-level data
 - Do not nest within standard geopolitical boundaries
 - Relevant data must be converted to fit
 - Users do not understand

Thank You

Questions?

Jennifer L. Rankin, PhD

jrankin@healthlandscape.org

www.healthlandscape.org

www.udsmapper.org

Roberta Weber

Oregon Child Care Research Partnership

Mapping to Geospatial Analysis:
Maps are Not Enough

Context

- Oregon created Early Learning Council
 - Charged with integrating early learning across early childhood, human services, health and other sectors
 - Created regional organizations, Early Learning Hubs, to integrate local services
- Oregon prioritized populations using an Equity Lens
- Oregon needed to identify communities with high percentages of children and families from targeted populations

Oregon Child Care Research Partnership Created Interactive Child Care Map

- Use GIS (Geographic Information Systems) software
- Integrate multiple data sources including:
 - Demographic data from US Census and commercial firms.
 - Content-specific data such as location, type, and size of child care and education facilities.
 - All data needs to be anchored with address, Census tract, or some other geographical unit.
- Use layers to display different types of data simultaneously including:
 - Point views: specific addresses such as those of child care and education facilities or schools.
 - Area views: geographic areas divided by boundaries of school, county, or Census Tract.

Data and Sources: Points

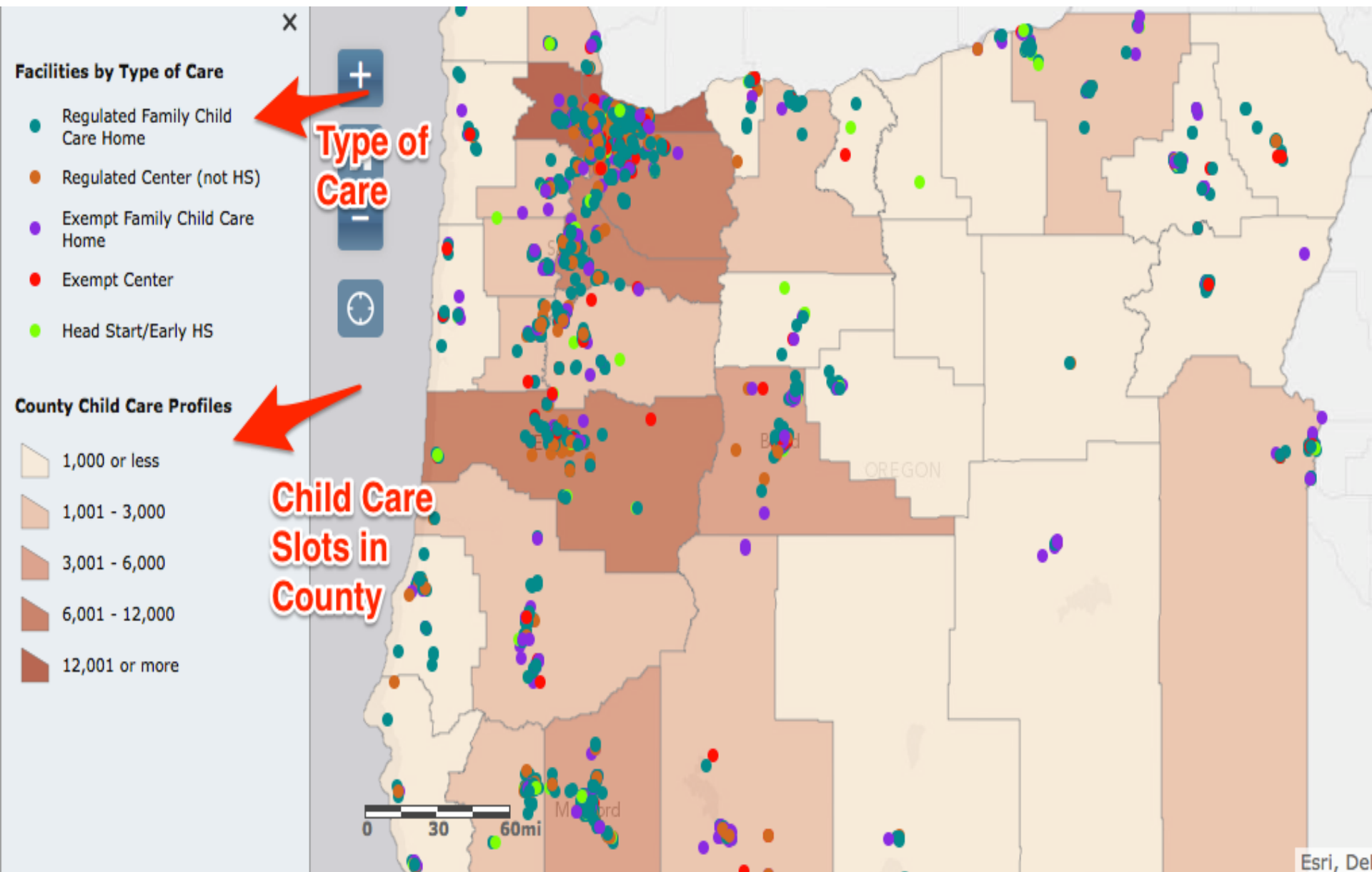
Points on the Map	Data Source
Elementary schools displayed by: <ul style="list-style-type: none">• poverty status of enrolled students• Kindergarten Assessment Scores• 3rd grade reading scores	Oregon Department of Human Services, Office of Forecasting, Research and Analysis
Child care and education facilities by: <ul style="list-style-type: none">• Type of care• Regulation status• Desired Capacity• Serve children on subsidy• QRIS rating	Oregon Child Care Research Partnership (OCCRP) using merge of R&R, licensing, subsidy, and QRIS data
Public preschool: Head Start, Preschool Promise, Relief Nurseries,	OCCRP using data from Early Learning Division, Oregon Department of Education
Early Learning Hubs	Oregon Early Learning Division

Data and Sources: Areas on the Map

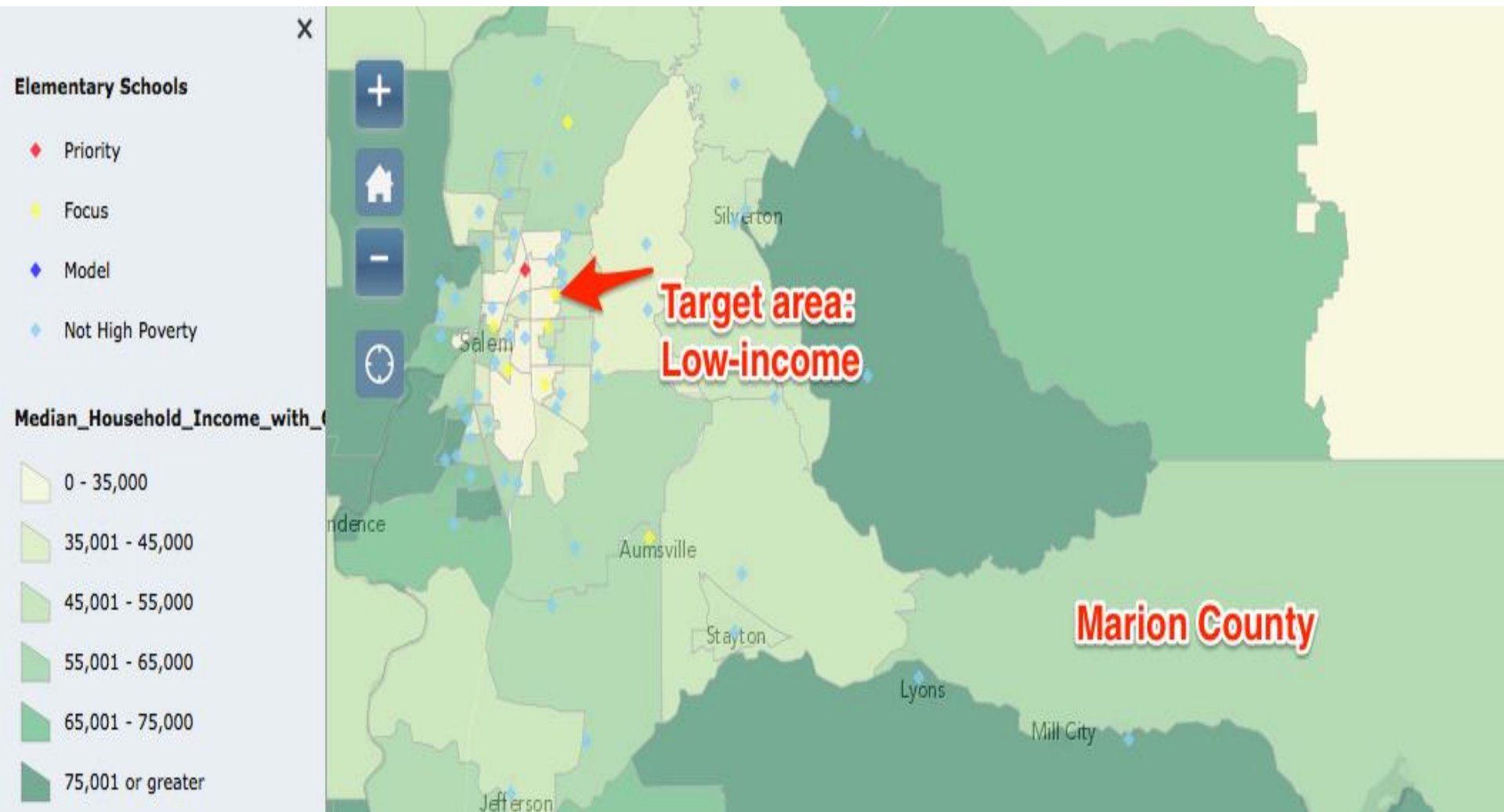
Areas on the Map	Data Sources
Elementary school and school district boundaries and child care capacity within boundaries	Oregon Department of Human Services, Office of Forecasting, Research and Analysis (OFRA)
Early Learning Hub Boundaries	OFRA
Program Participation <ul style="list-style-type: none">• Medical Assistance• TANF Households• Children in Paid Foster Care• Child Welfare Assessments• SNAP Recipients	OFRA
Median household income for households with children under 18.	US Census, ACS 2015 5 year estimates.
Population of children under age 18.	Esri's Demographics.
Diversity index.	Esri's Demographics.
County boundaries.	Esri

Manually Created Maps Identify Areas of High Need

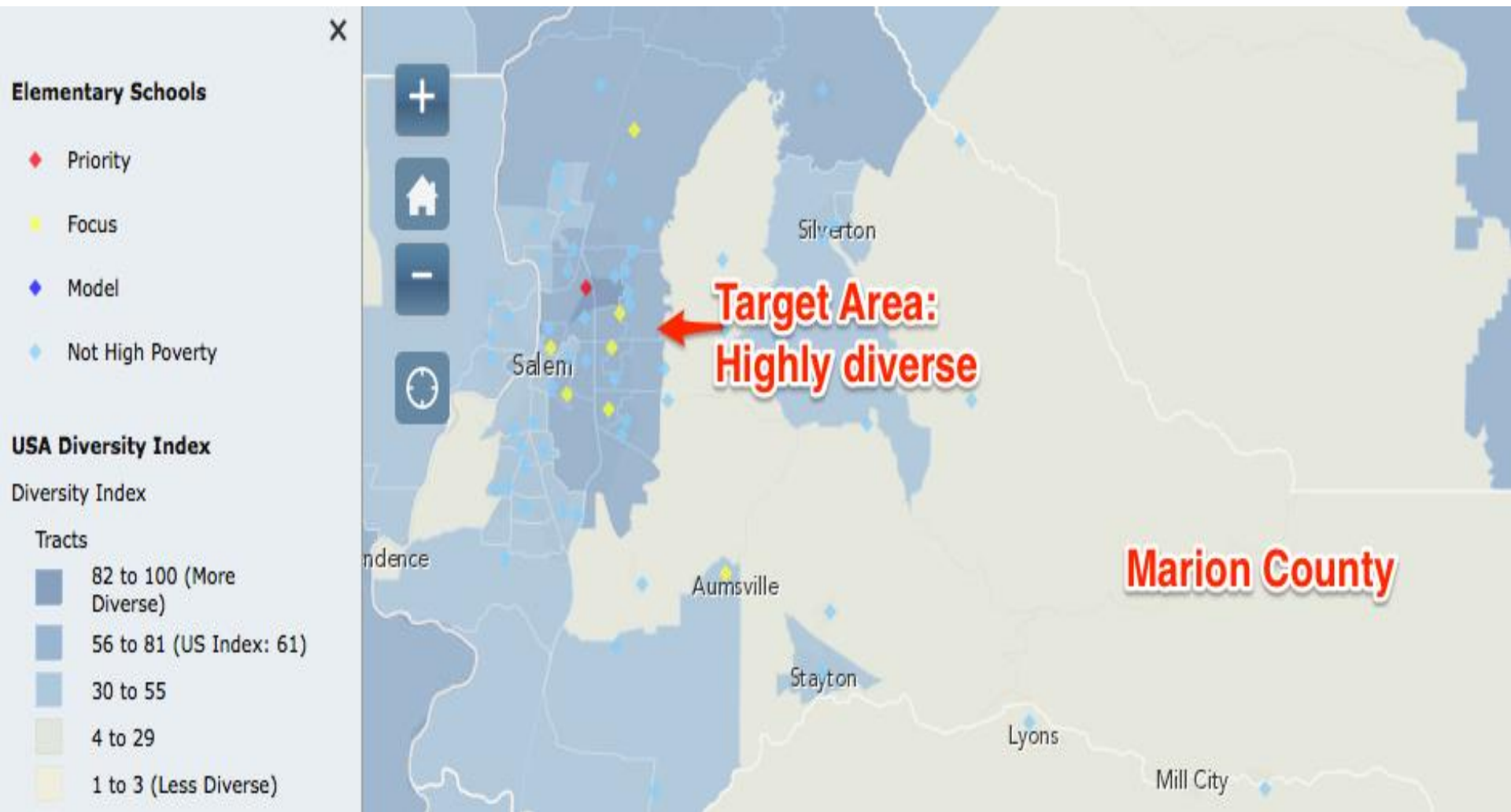
Begin with Focus on a Single County: Marion



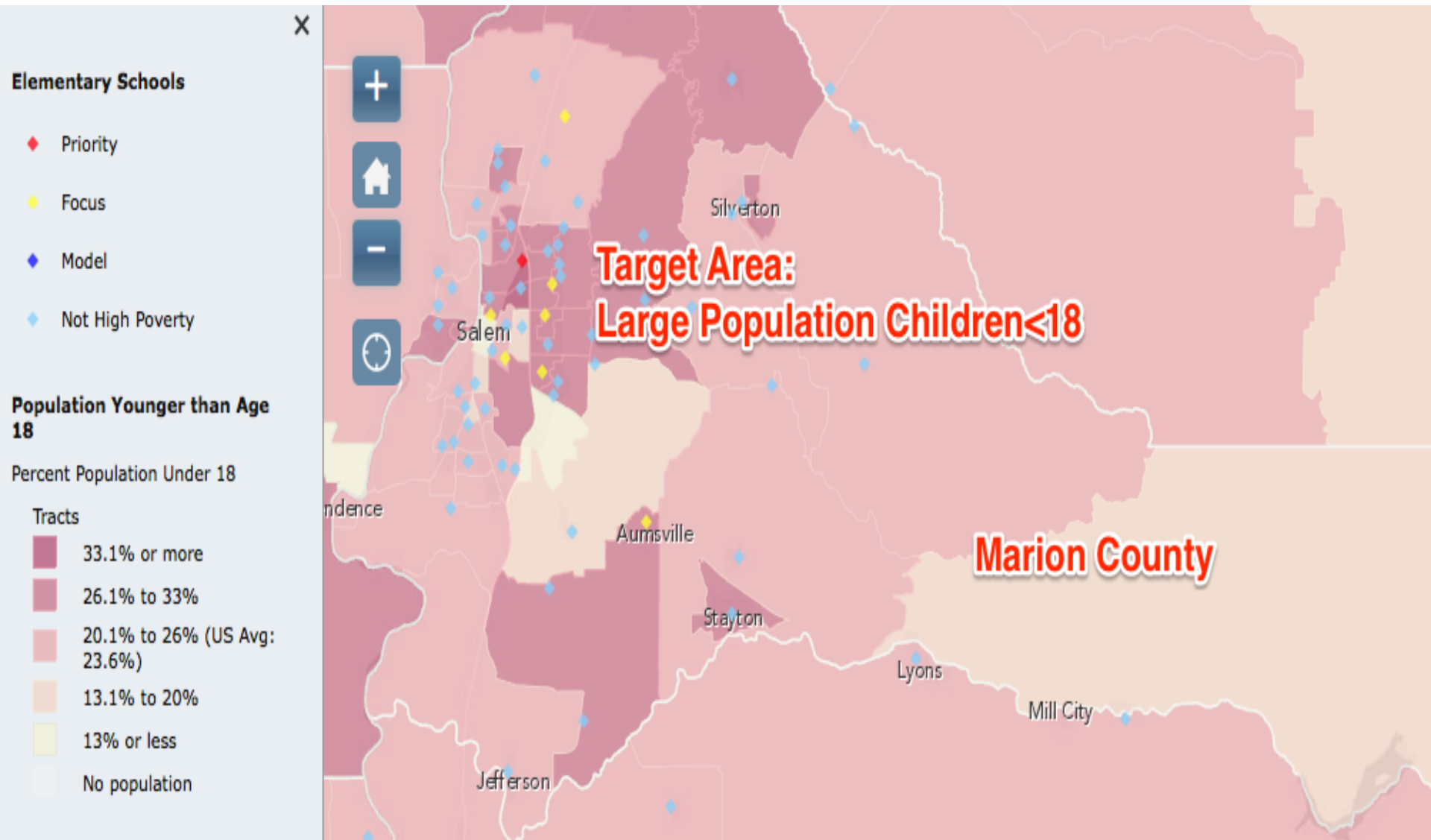
Identify Low Income Elementary School Areas (Priority Schools)



Add High Diversity



Identify school with high poverty, diversity, and large percentage children



Need Power of Geospatial Analytics

- Manual identification of needs laborious & limited
- Found partner whose work is conducting studies with geospatial analytics
- New study will answer:
 - How do child outcomes vary across communities (e.g., elementary school catchment areas)?
 - How do communities (e.g., elementary school catchment areas) across the state vary in terms of need for increased investment, and in which service sectors?

Oregon Interactive Child Care Map can be found at:

<http://geo.maps.arcgis.com/apps/webappviewer/index.html?id=5242e1c28751484fa5887c4767bf6a79>

Early Childhood Cartography: A Preschooler's First Continent Map

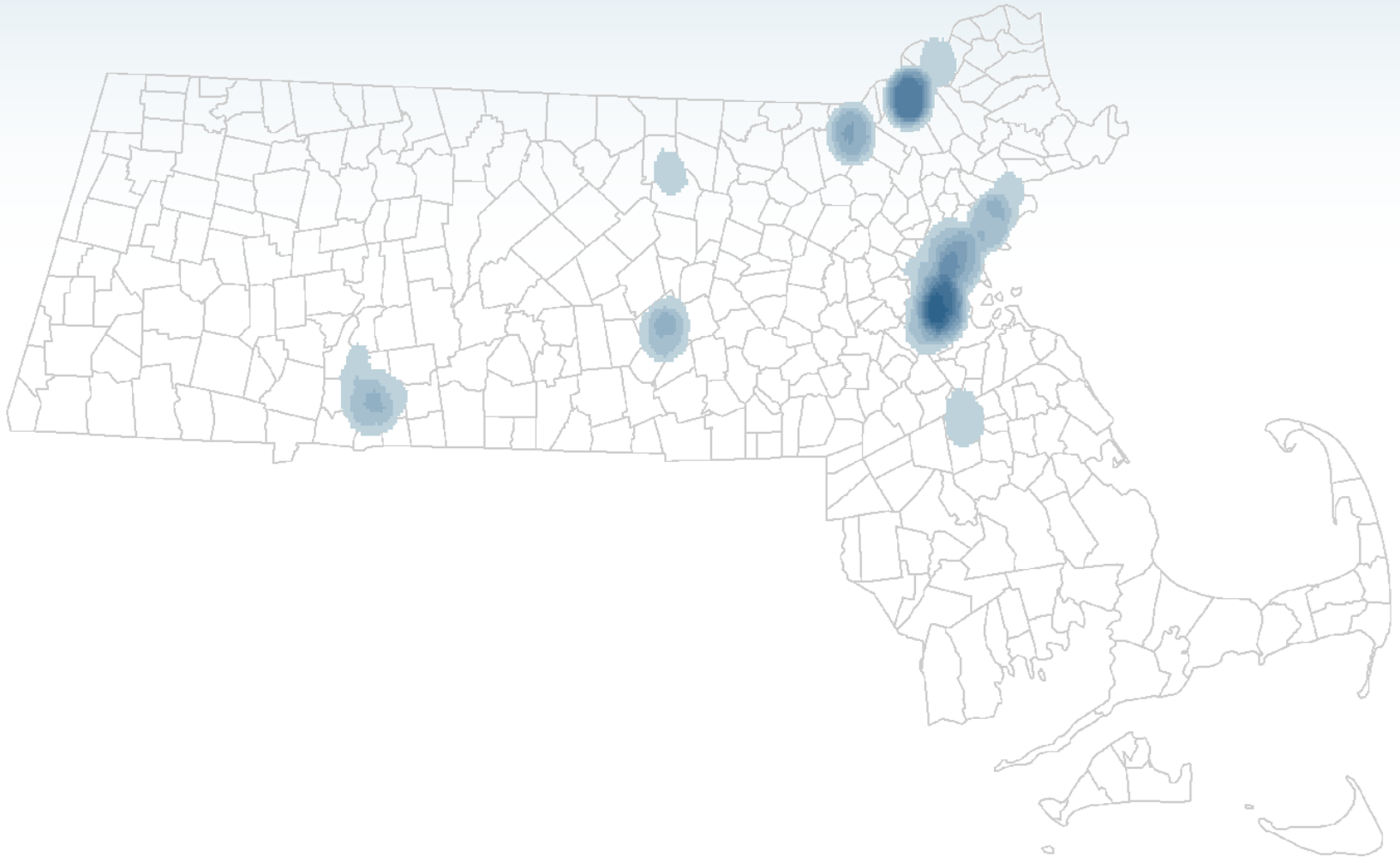


--Ellie Bird Hardy (Age 4; Dec 2013)

Extra slides

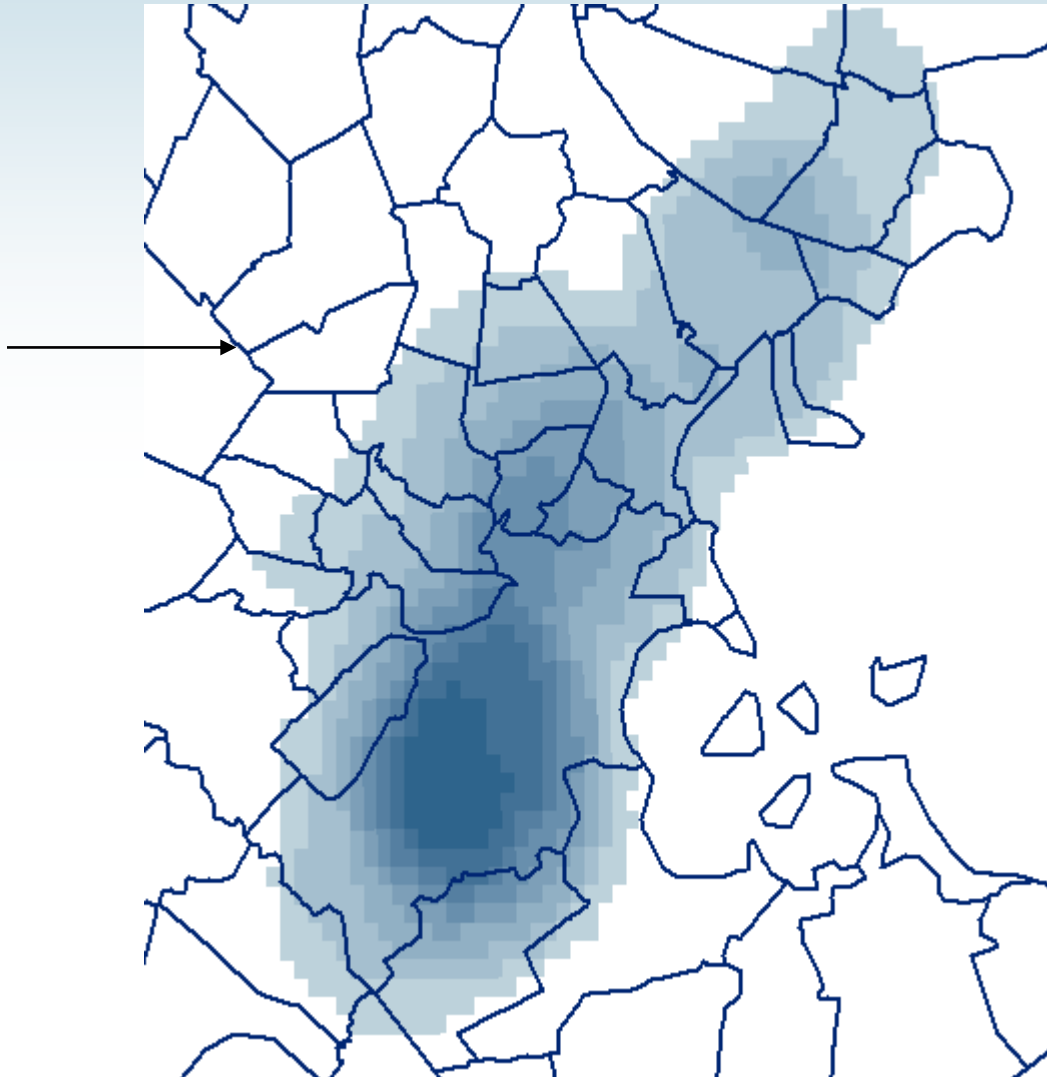
What is Exploratory Spatial Data Analysis?

Density (“Heat”) Map of Subsidy Provider Locations



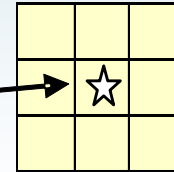
What is Exploratory Spatial Data Analysis?

Census tract
boundaries

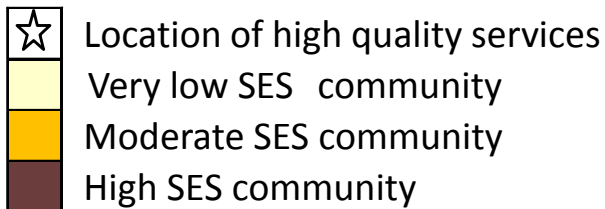
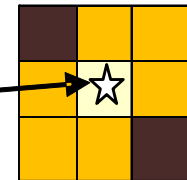


Policy-relevant hypothetical spatial configurations

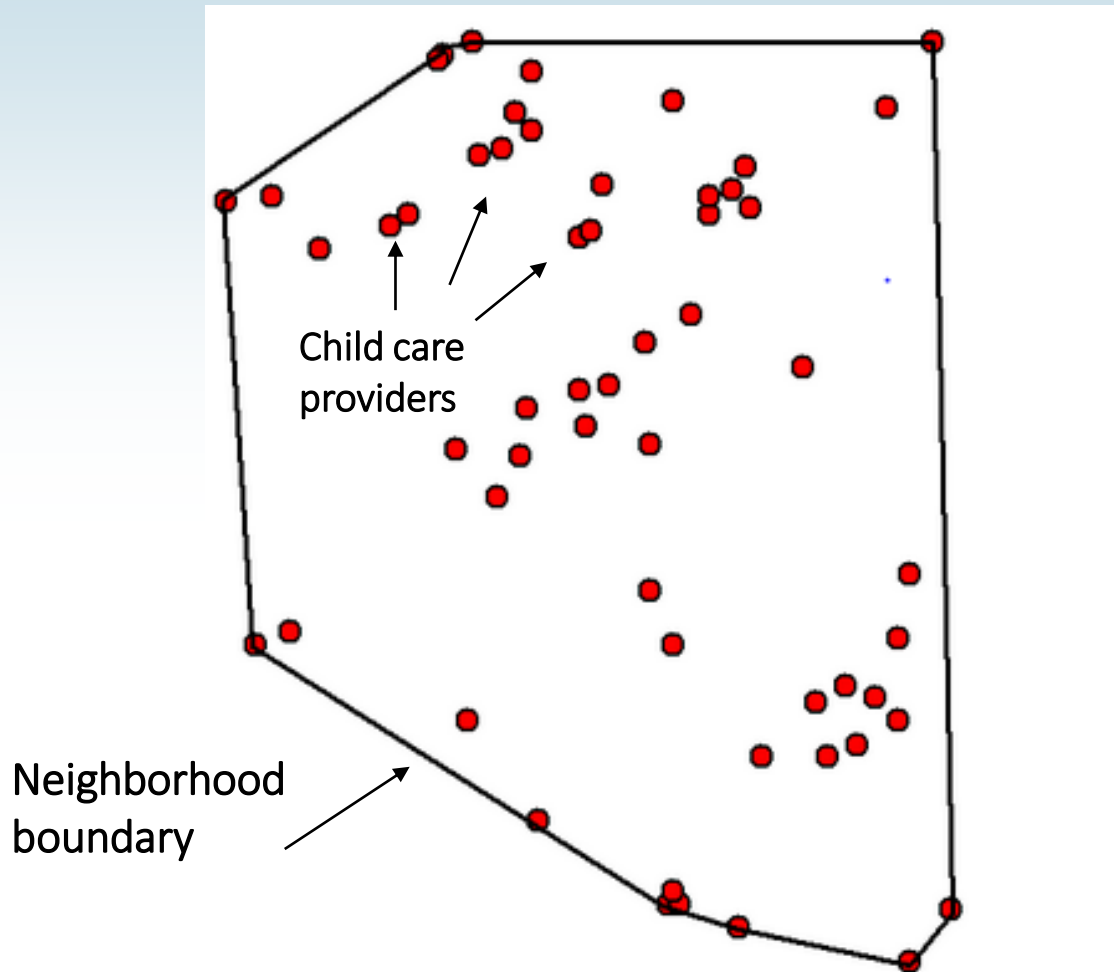
A tendency for high quality services to be located in areas of spatially concentrated disadvantage



A tendency for high quality services to be located in low opportunity areas whose neighbors are areas of higher opportunity



Basic Child Care GIS application



Summary stats

- 51 providers in the Blue Hills neighborhood
- Total area of neighborhood=2 square miles
- Provider density=25.5 providers per square mile