

Indicators of Community Vulnerability to Extreme Events: Considering Sites and Waste Management Facilities

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Authors and Acknowledgments

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Project Overview

- Context
 - When extreme events happen, hazardous materials or contaminants may be accidentally released from sites and waste facilities creating further hazards for surrounding communities
 - Understanding community vulnerabilities underlies preparedness, mitigation planning, and revitalization decisions.
- Goal: Develop indicator-based vulnerability approach to help decision-makers in
 - Identifying vulnerable communities and specific sources of vulnerability
 - Tracking sites and facilities
 - Communicating how extreme events may impact sites/waste facilities and the surrounding community
- Project scope
 - Pollutants released by sites and facilities that are either actively managing or have a history of hazardous substances, wastes or contamination
 - Extreme heat, floods, droughts, wildfires
 - Develop indicators (informed by models)

Stakeholder Engagement

- Demonstrate and refine approach using two case studies (Maricopa County, AZ and Waterbury, CT)
 - Determine scope and area to study
 - Collaborate with stakeholders to identify key areas of vulnerability and the indicators
 - Review methods and data needs with the community so the selected indicators are community relevant
 - Seek feedback on terminology to be clear
 - Ask for feedback on visuals so they clearly communicate key results to the community
- Examples of decision points where indicators may be useful to stakeholders
 - City and neighborhood land use and preparedness planning
 - Transportation, housing, and community development
 - Environmental assessment and cleanup

Potential Impacts of Extreme Events on Sites and Waste Facilities

Extreme Heat

- Increased fire hazards
- High pressures in closed vessels/tanks
- Overheating of equipment
- Off-gassing
- Changes to remediation effectiveness
- Power fluctuations/outages

Wildfires

- Catastrophic damage to facilities, ignitable wastes
- Incident waste facility closures
- Increased hazardous/nonhazardous waste generation
- Acute air quality incident/emergency: Hazardous smoke plume

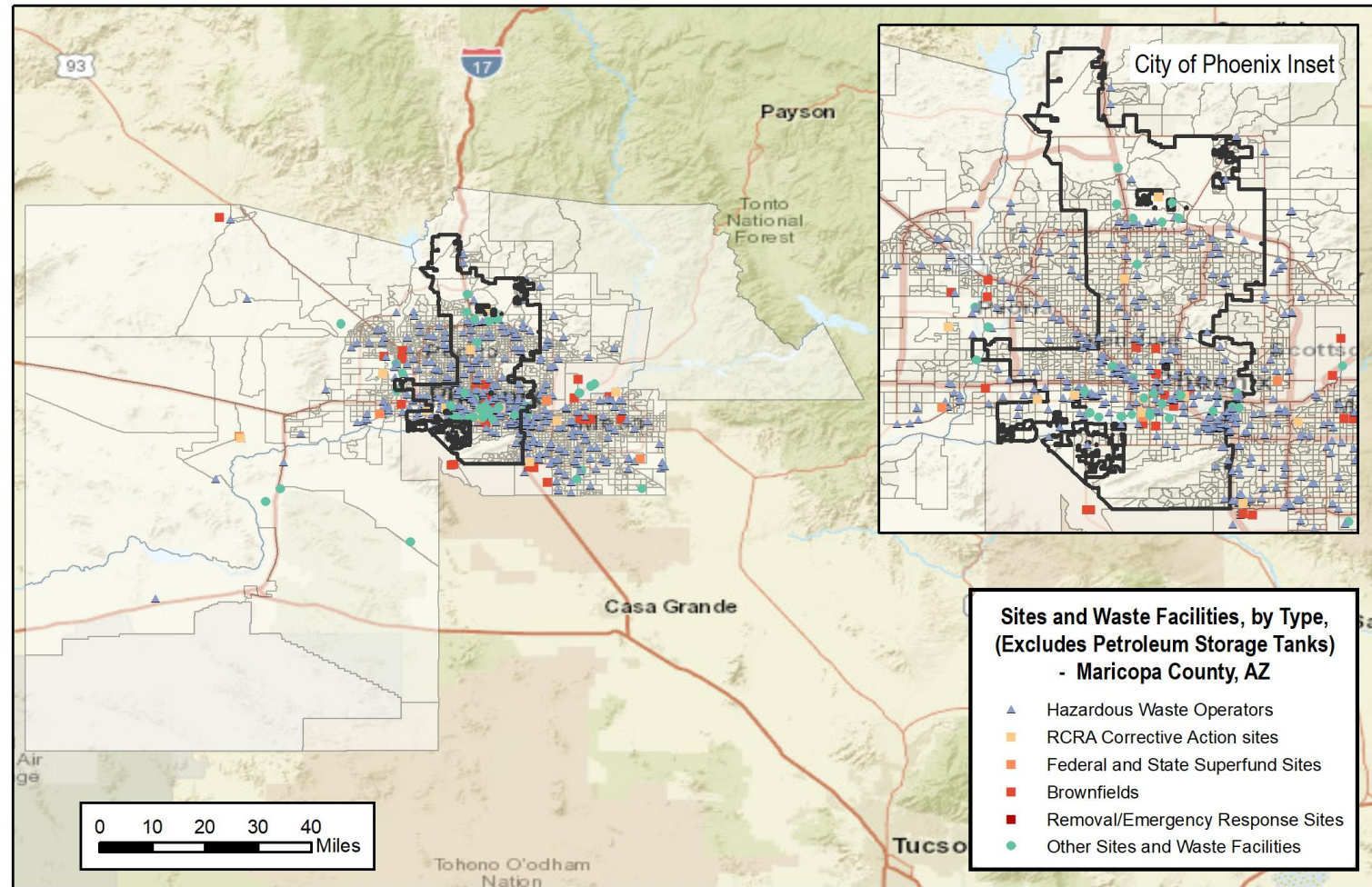
Drought

- Increased fire hazards, fugitive dust
- Changes to remediation effectiveness
- Changes in groundwater plume dynamics due to lower water table
- Water use restrictions impacts
- Increased scrutiny of groundwater extraction systems

Floods

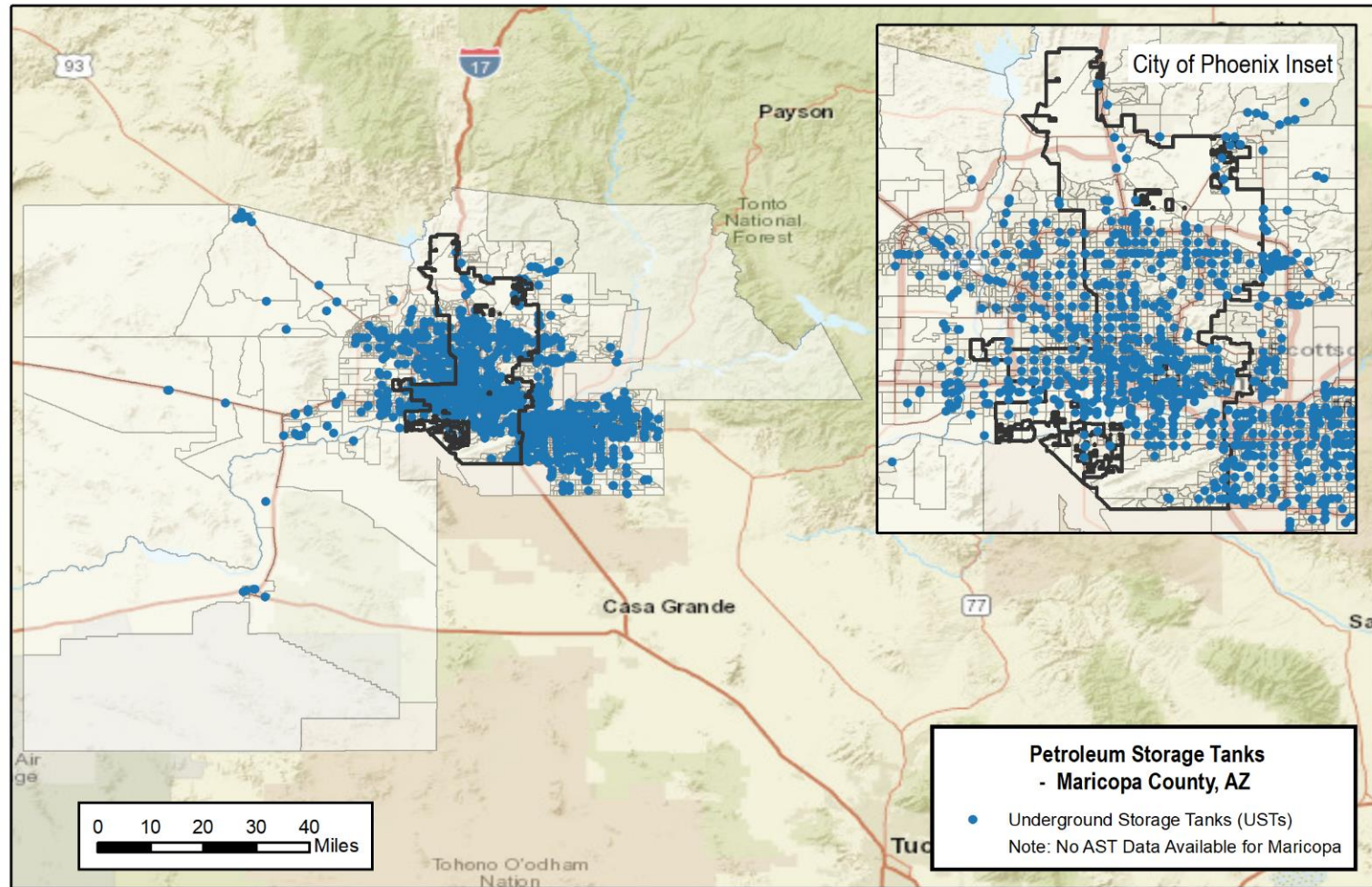
- Erosion may be more likely
- Ponding/storm water management difficult
- Water damage (corrosion, water logging)
- Power fluctuations/outages
- Groundwater plume changes and higher water table
- Spreading/migration of contamination
- Catastrophic events destroy structures
- Releases from overwash, infiltration and leaching
- Incident waste facility closures
- Increased hazardous/nonhazardous waste generation
- Groundwater pump-and-treat remedies may not be allowed to discharge
- Increased potential for flooding of treatment systems
- Dislodged debris from treatment/containment systems or contained wastes

Sites and Waste Facilities, by Type* (Excludes Petroleum Storage Tanks)



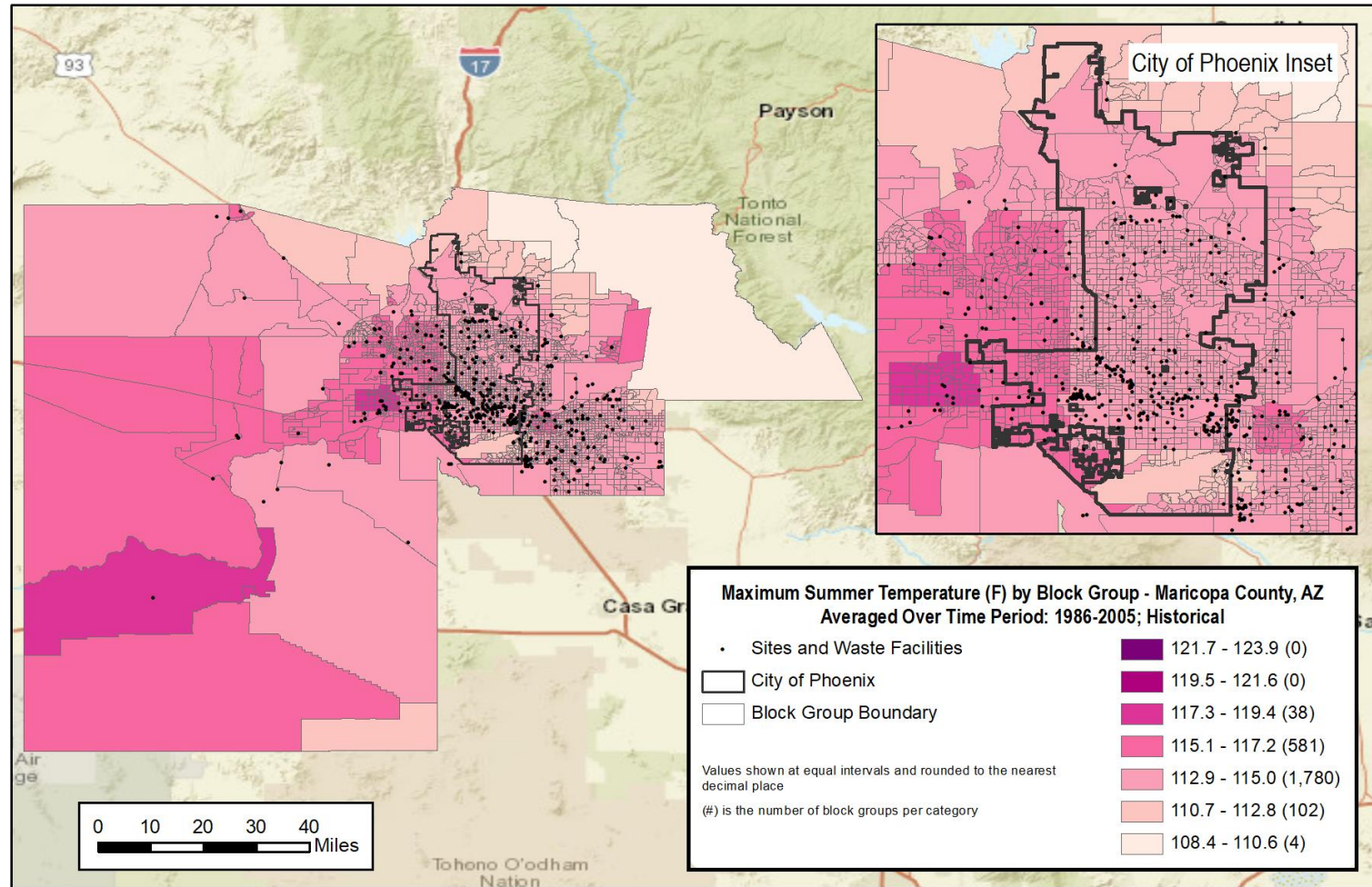
*Data extracted from public EPA/State data sources in 2017 and reflect the quality of the sources at that time. We vetted the data with EPA Regions/local stakeholders to the best of our ability.

Petroleum Storage Tanks*



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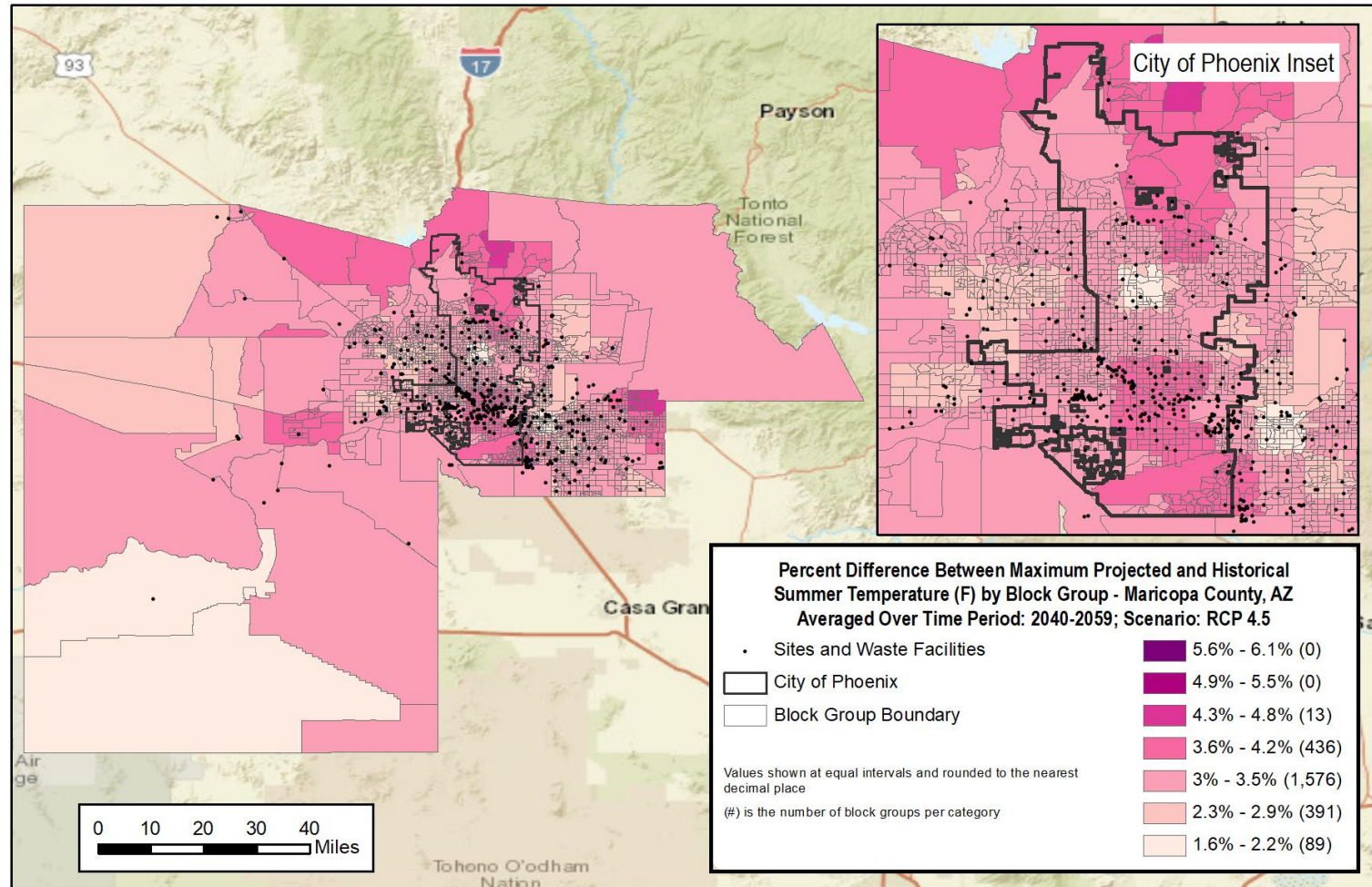
Extreme Heat: Maximum Summer Temperature, by Block Group Historical (Averaged Over 1986-2005)



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Percent Difference of Projected (2040-2059) from Historical (1986-2005)

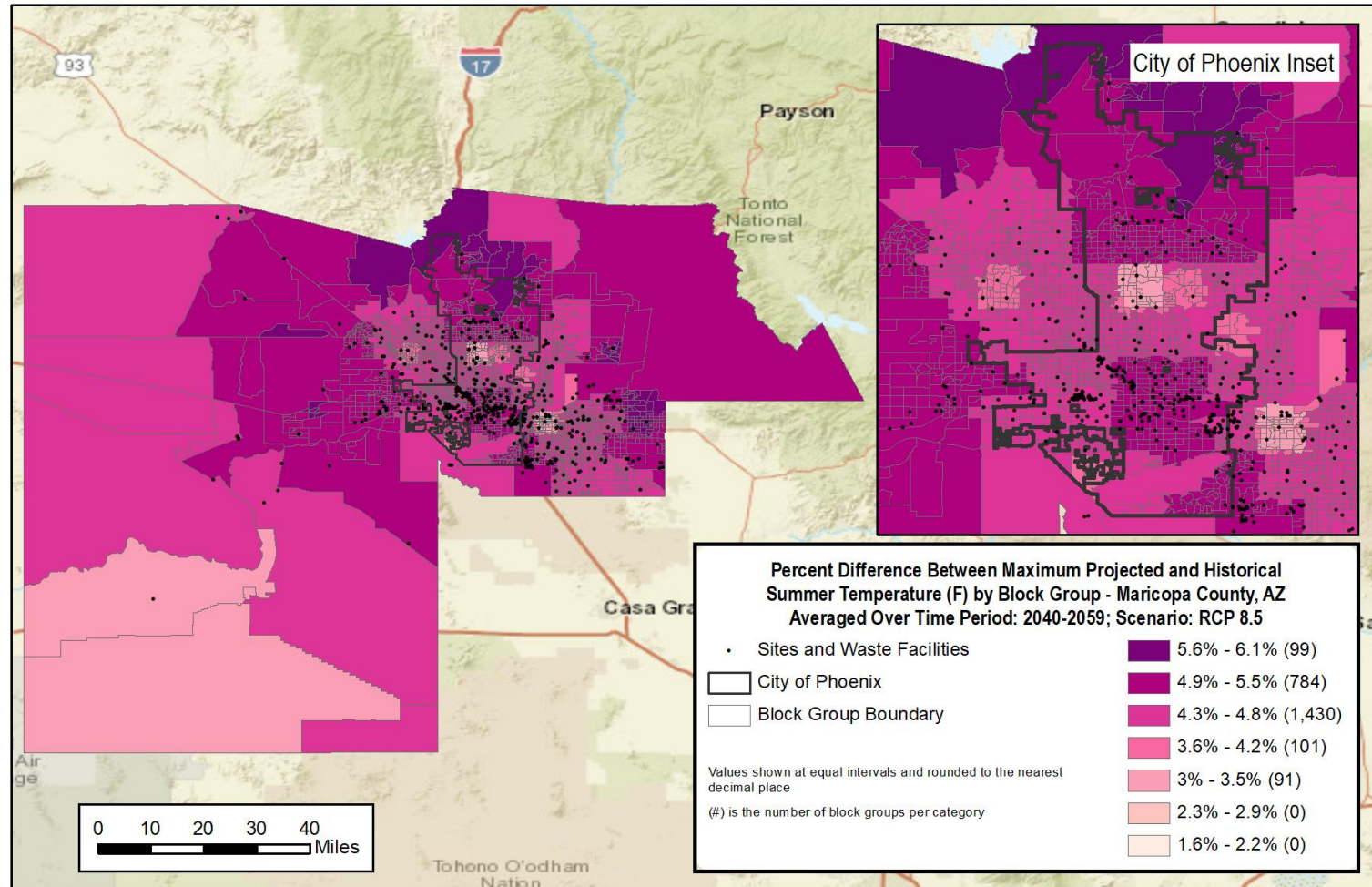
Scenario: RCP 4.5



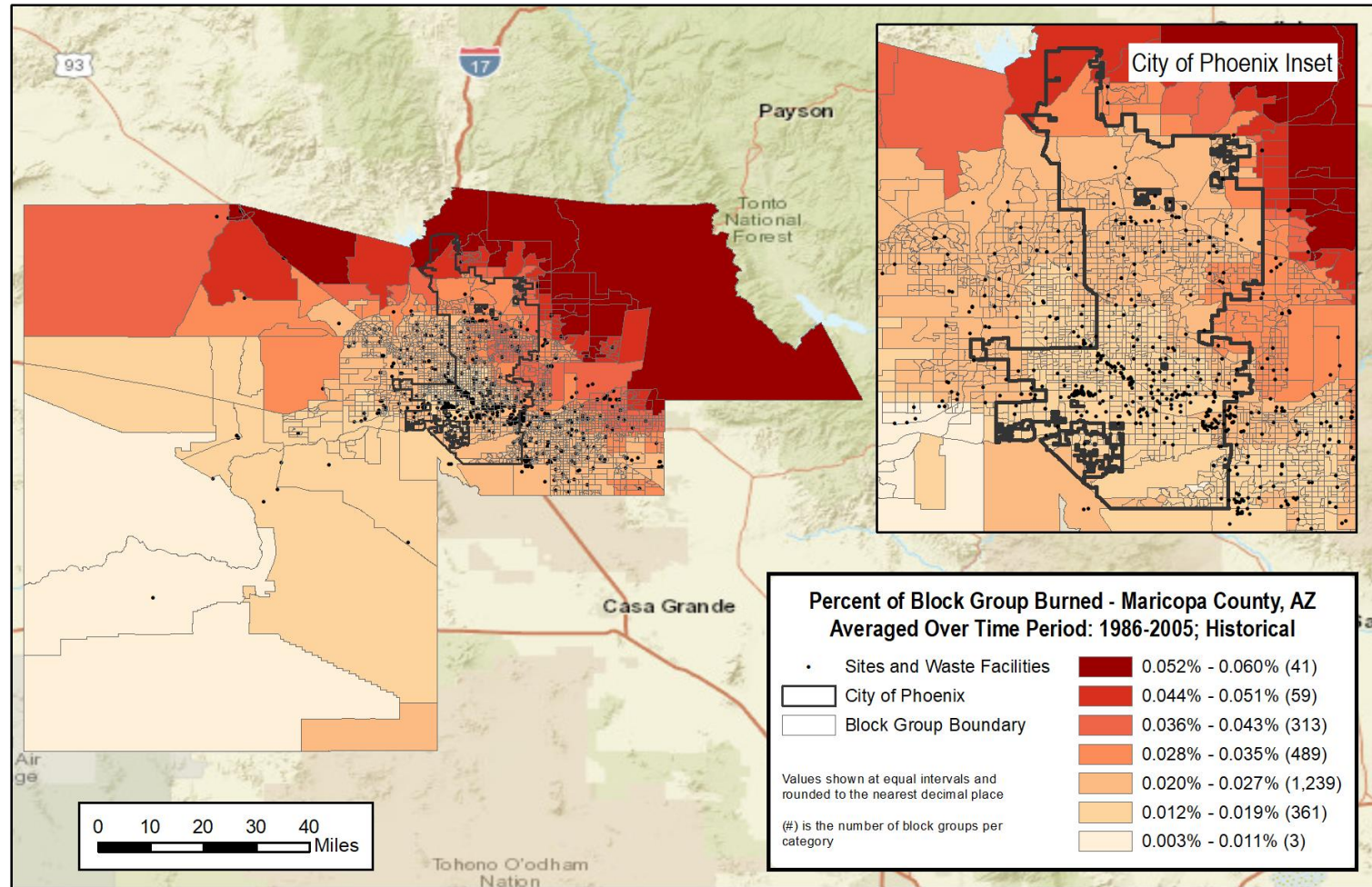
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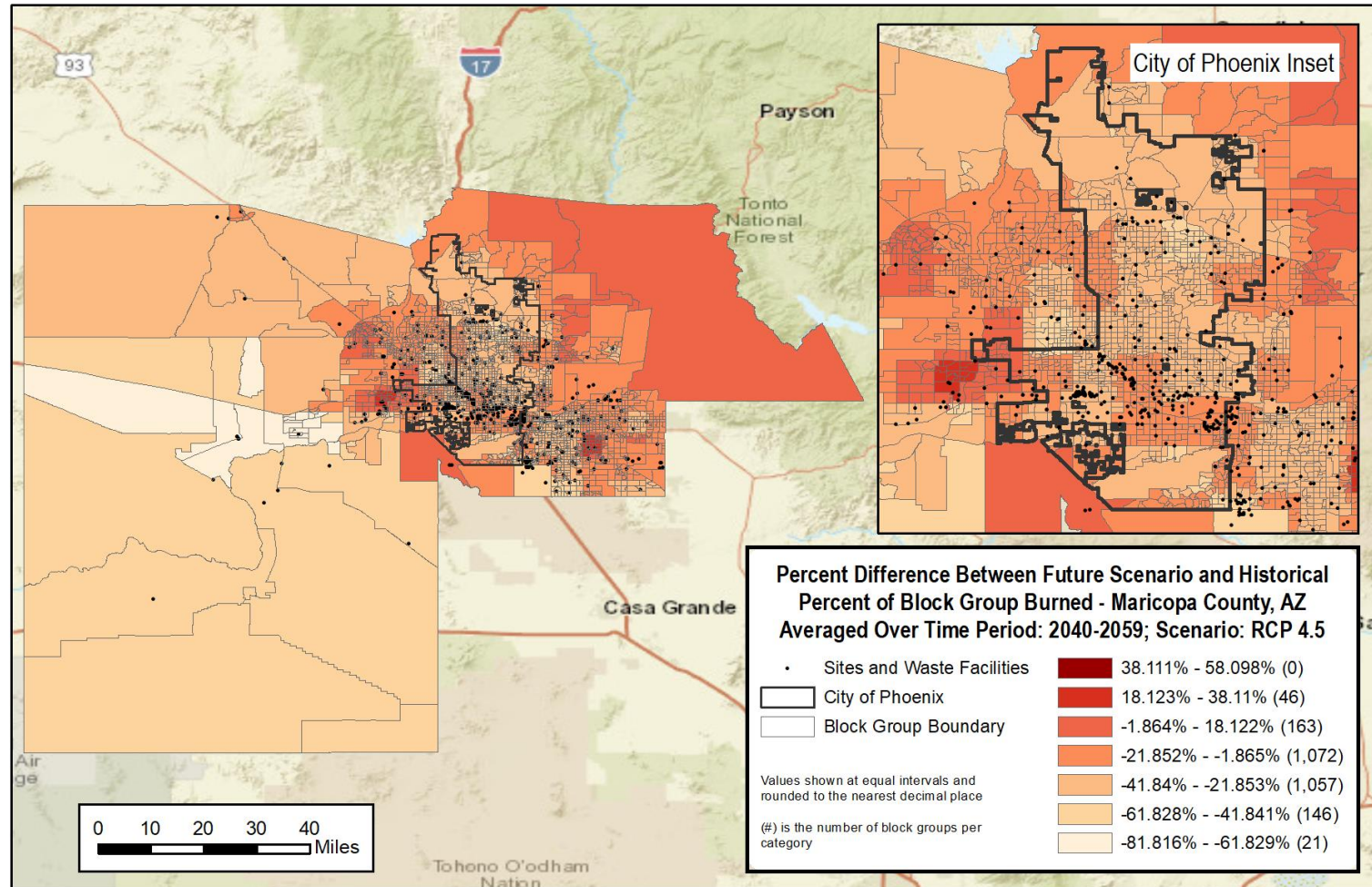
Wildfire: Percent of Block Group Area Burned Historical (Averaged Over 1986-2005)



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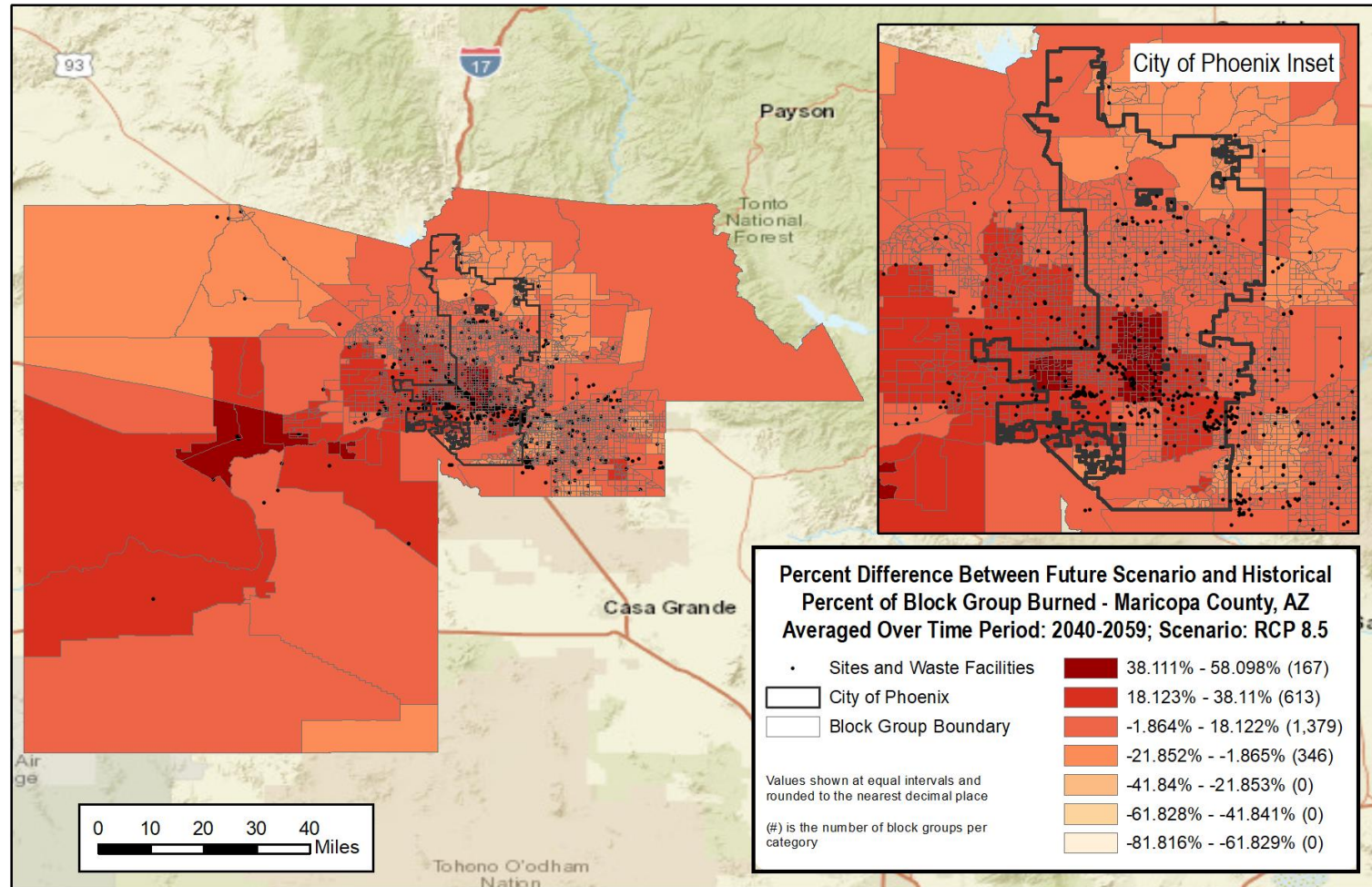
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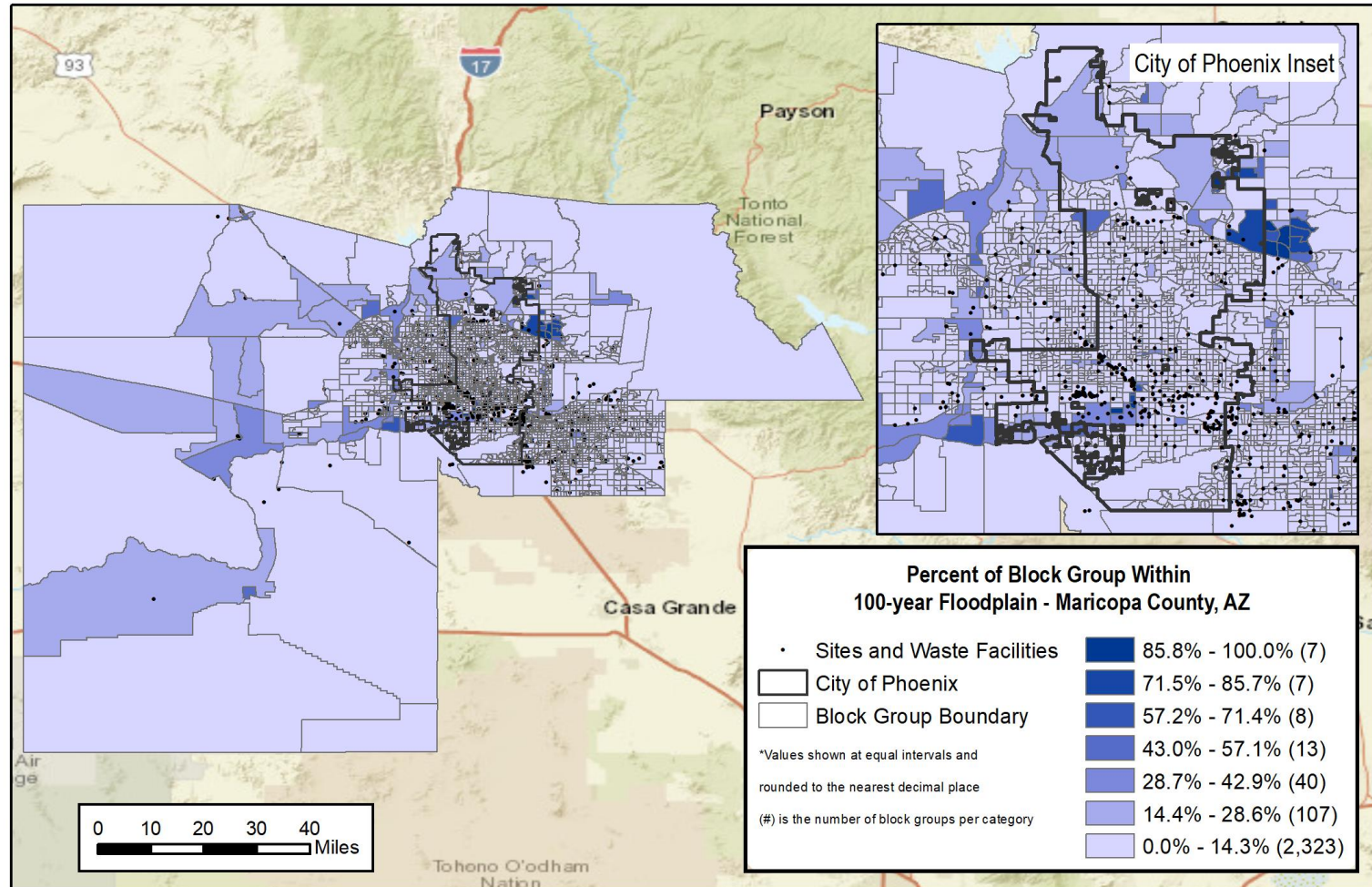
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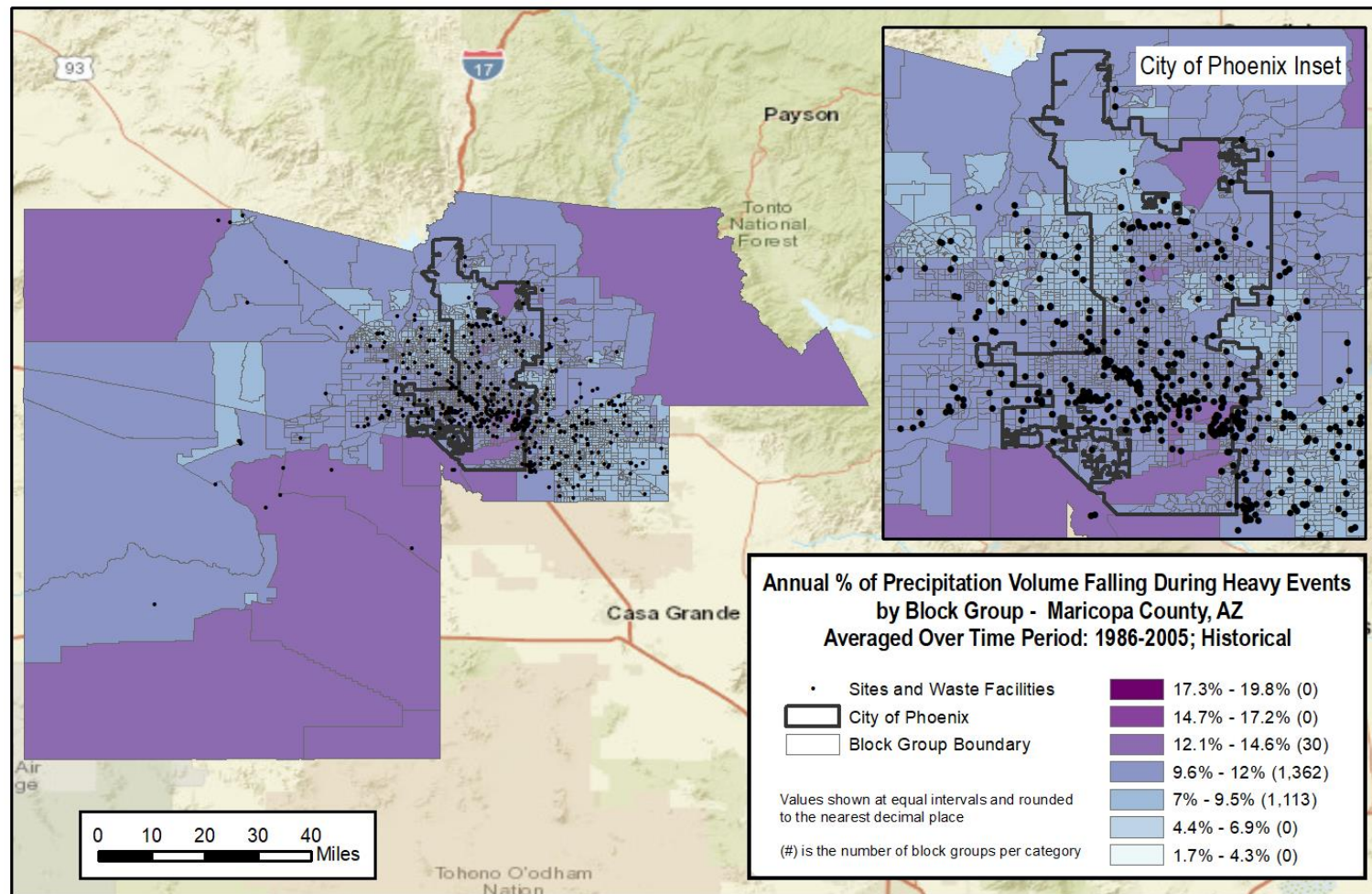
Scenario: RCP 8.5



Floods: Percent of Block Group within a 100-Year Floodplain Historical

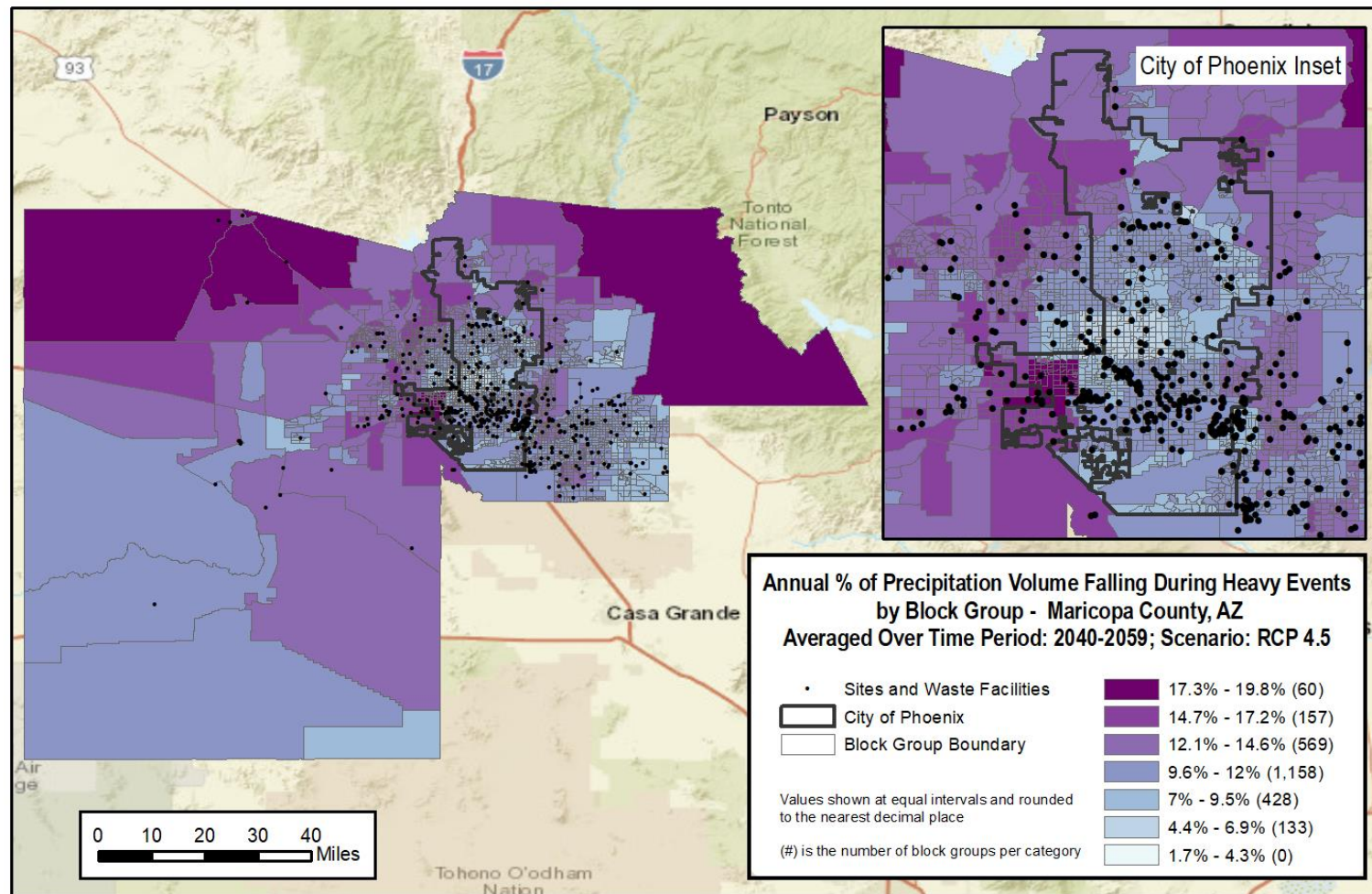


Precipitation-Based Flood Indicator: Annual % of Precipitation Volume Falling During Heavy Events*, by Block Group Historical (Averaged Over 1986-2005)



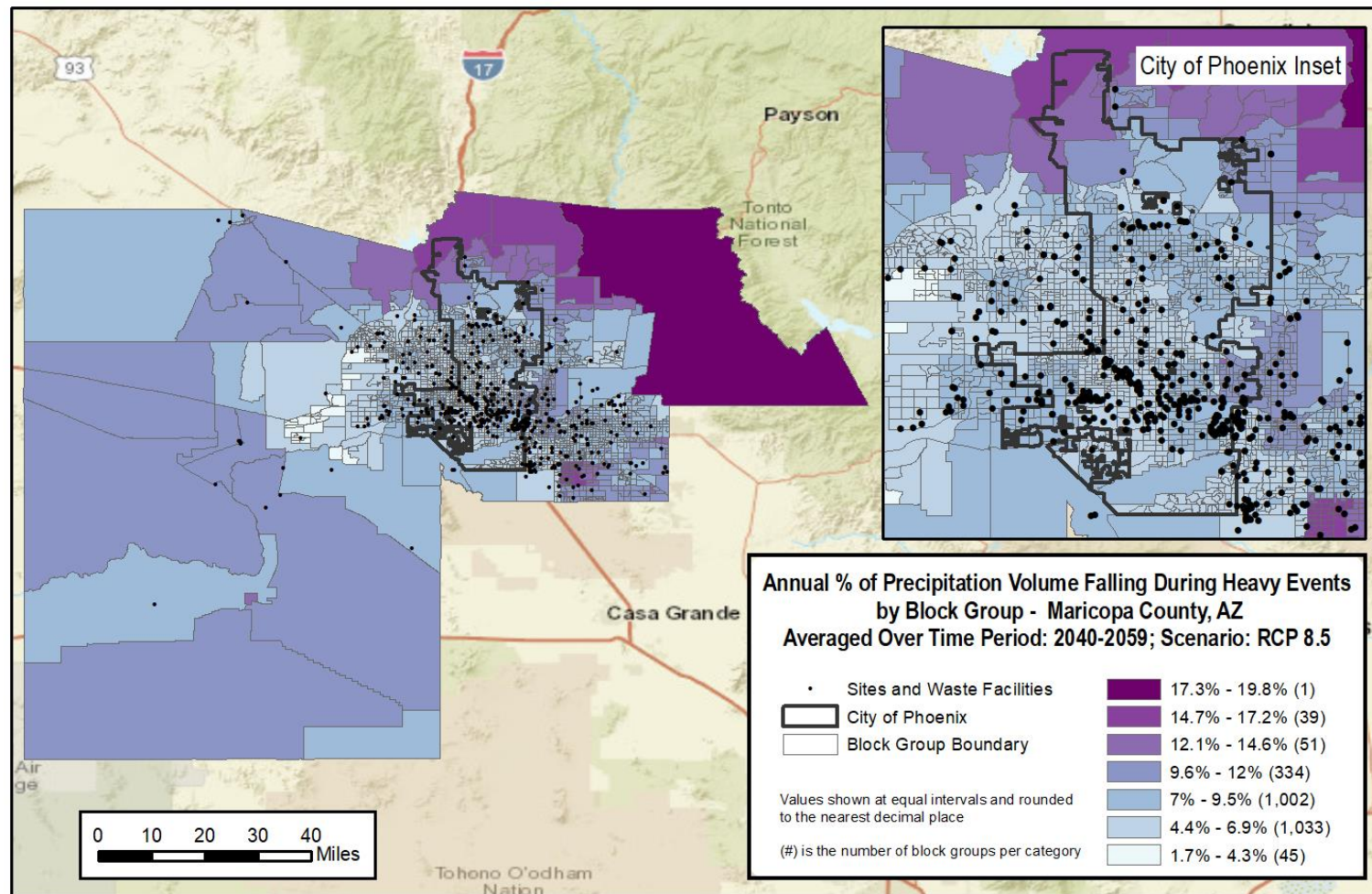
*Heavy events: Daily precipitation volume > 99th percentile for 1986-2005

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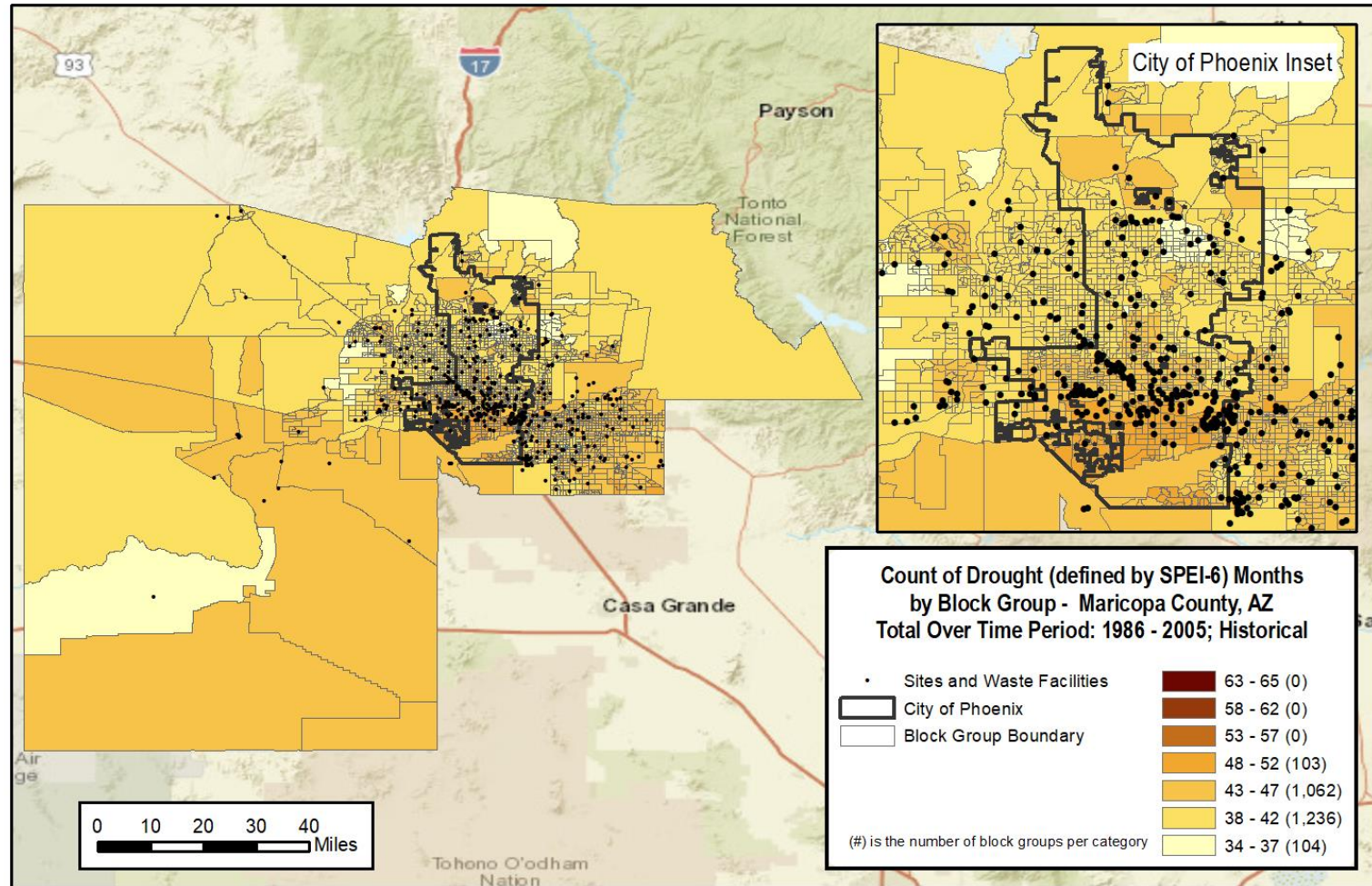
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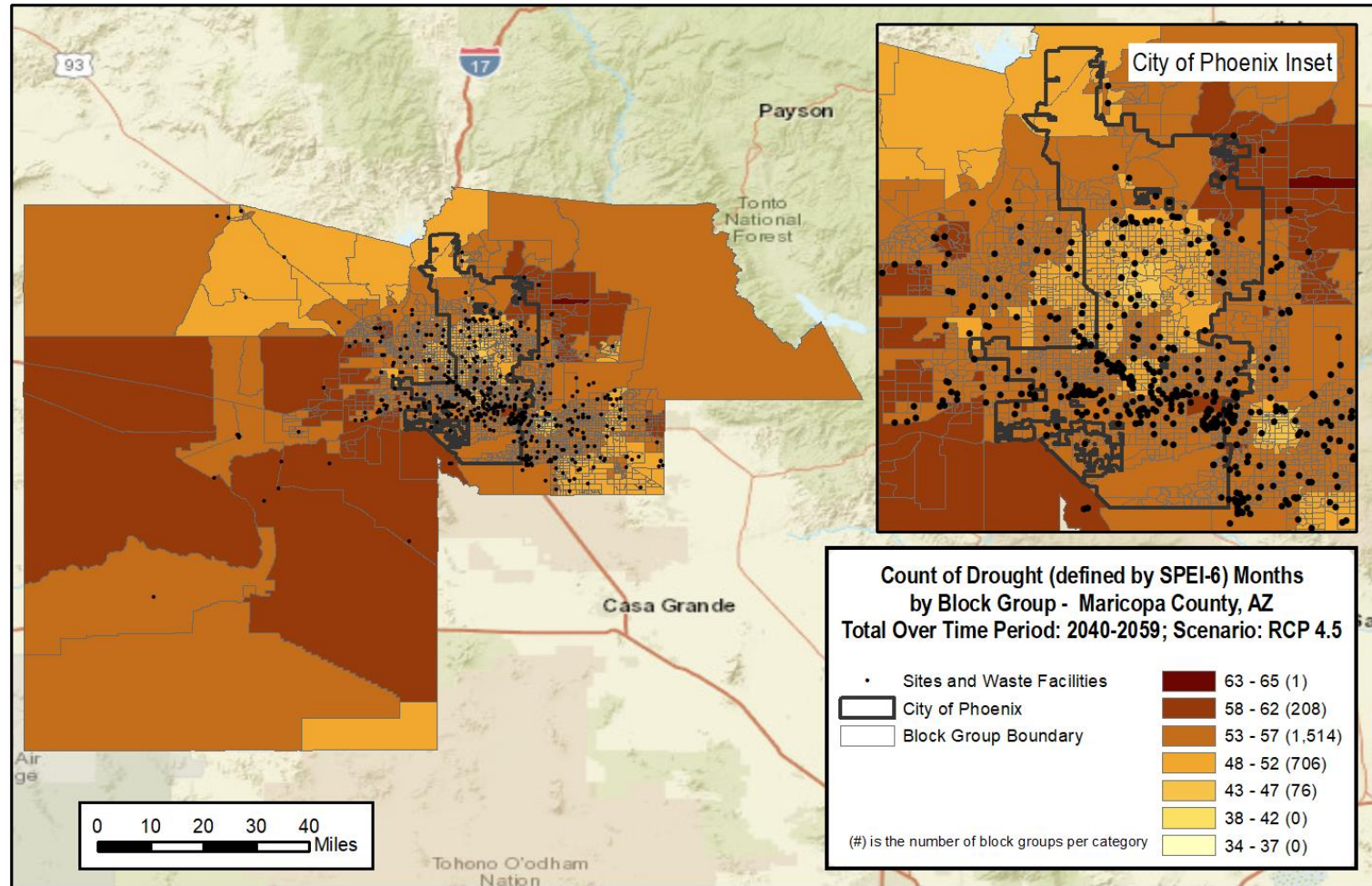


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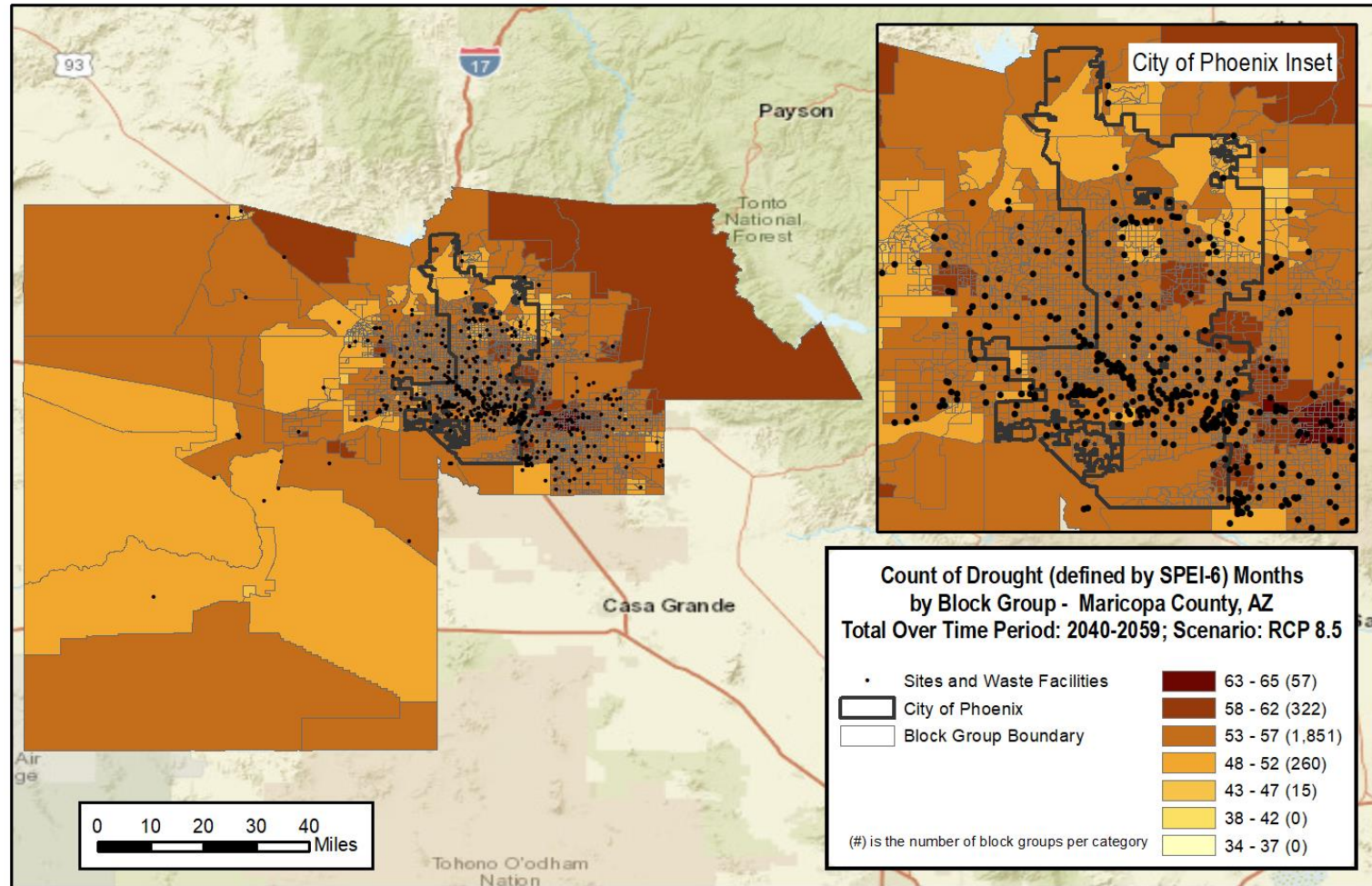
Drought: Count of Drought (Defined by SPEI-6) Months, by Block Group Historical (Total Over 1986-2005)



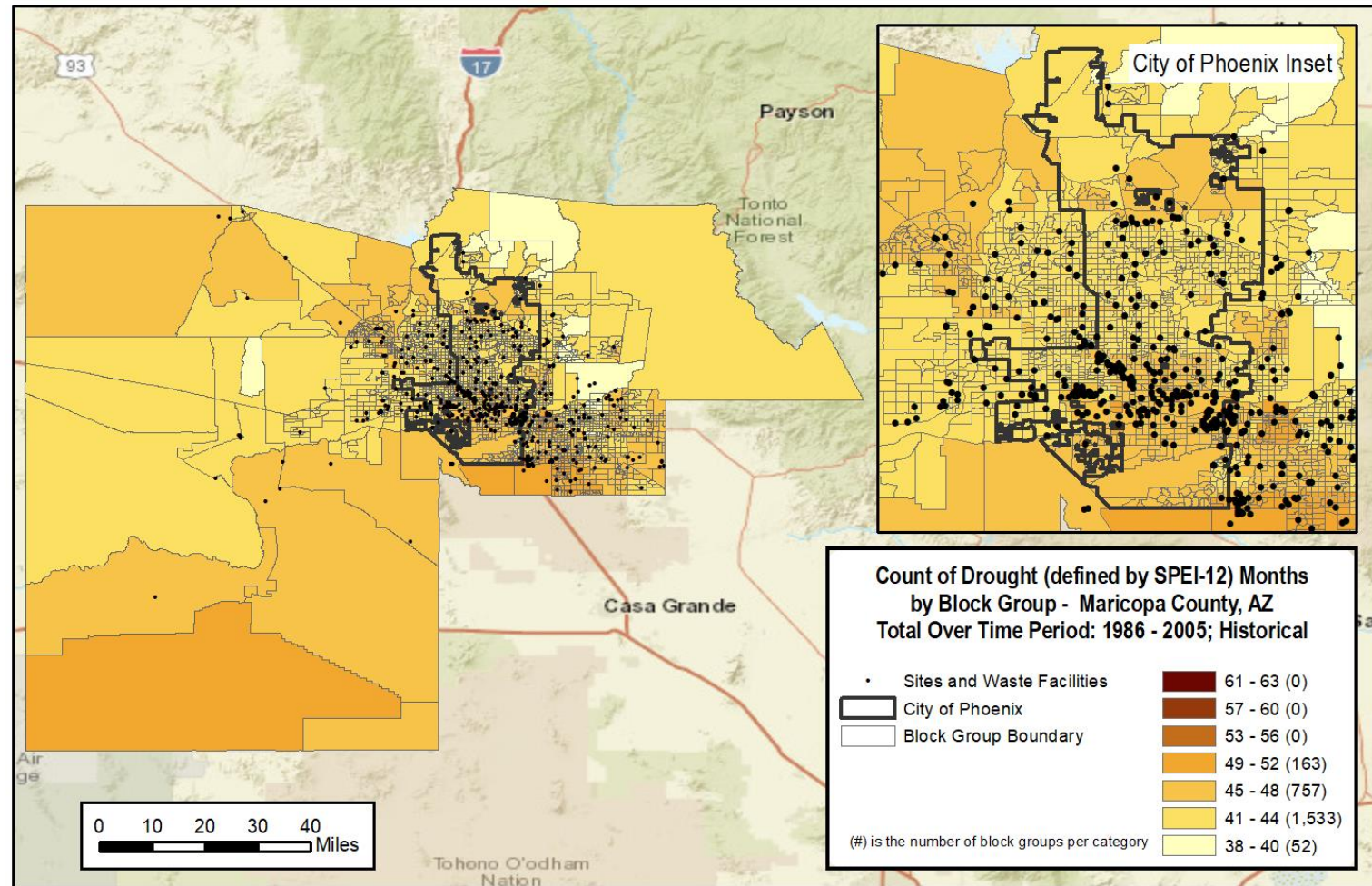
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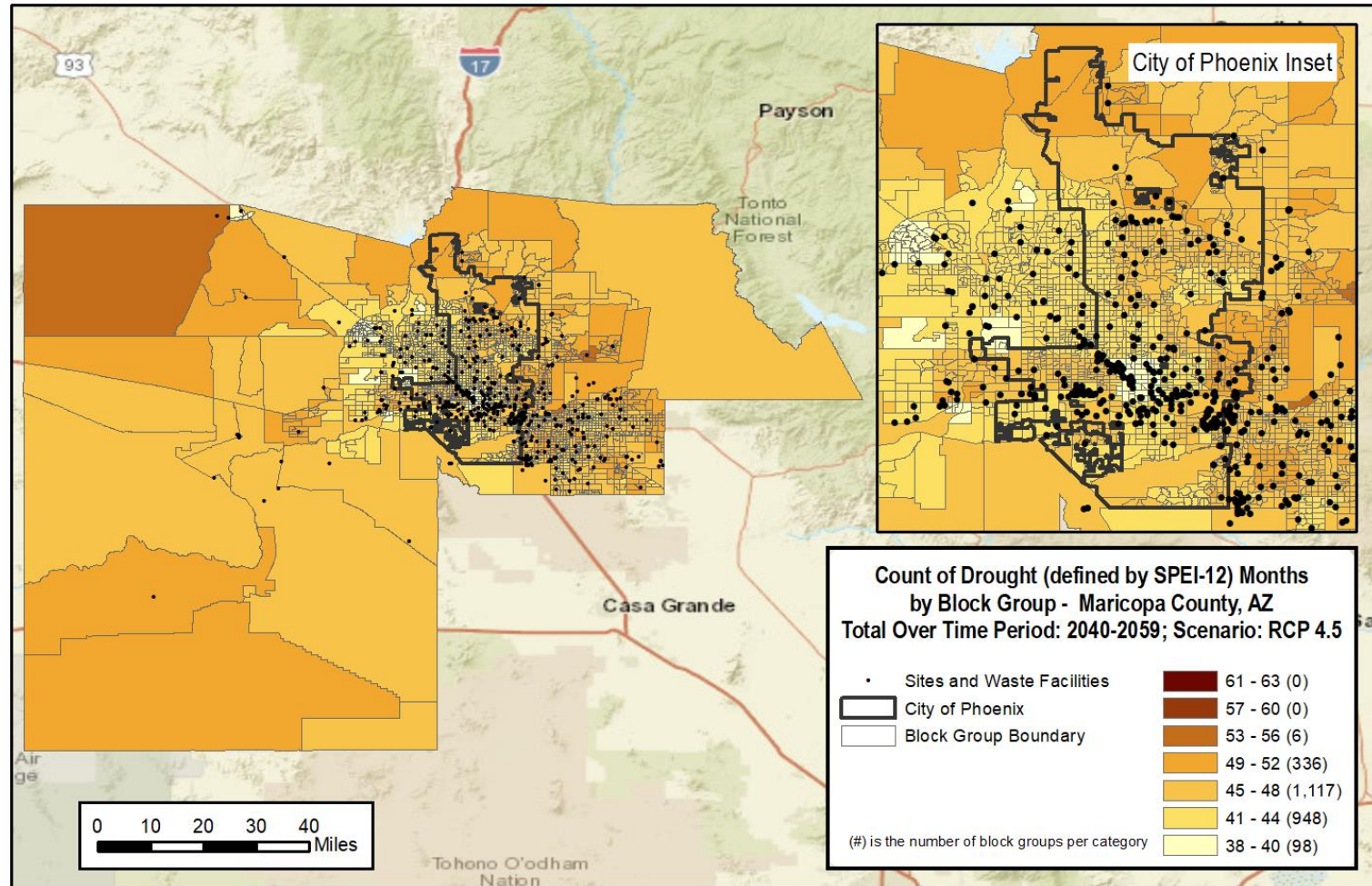
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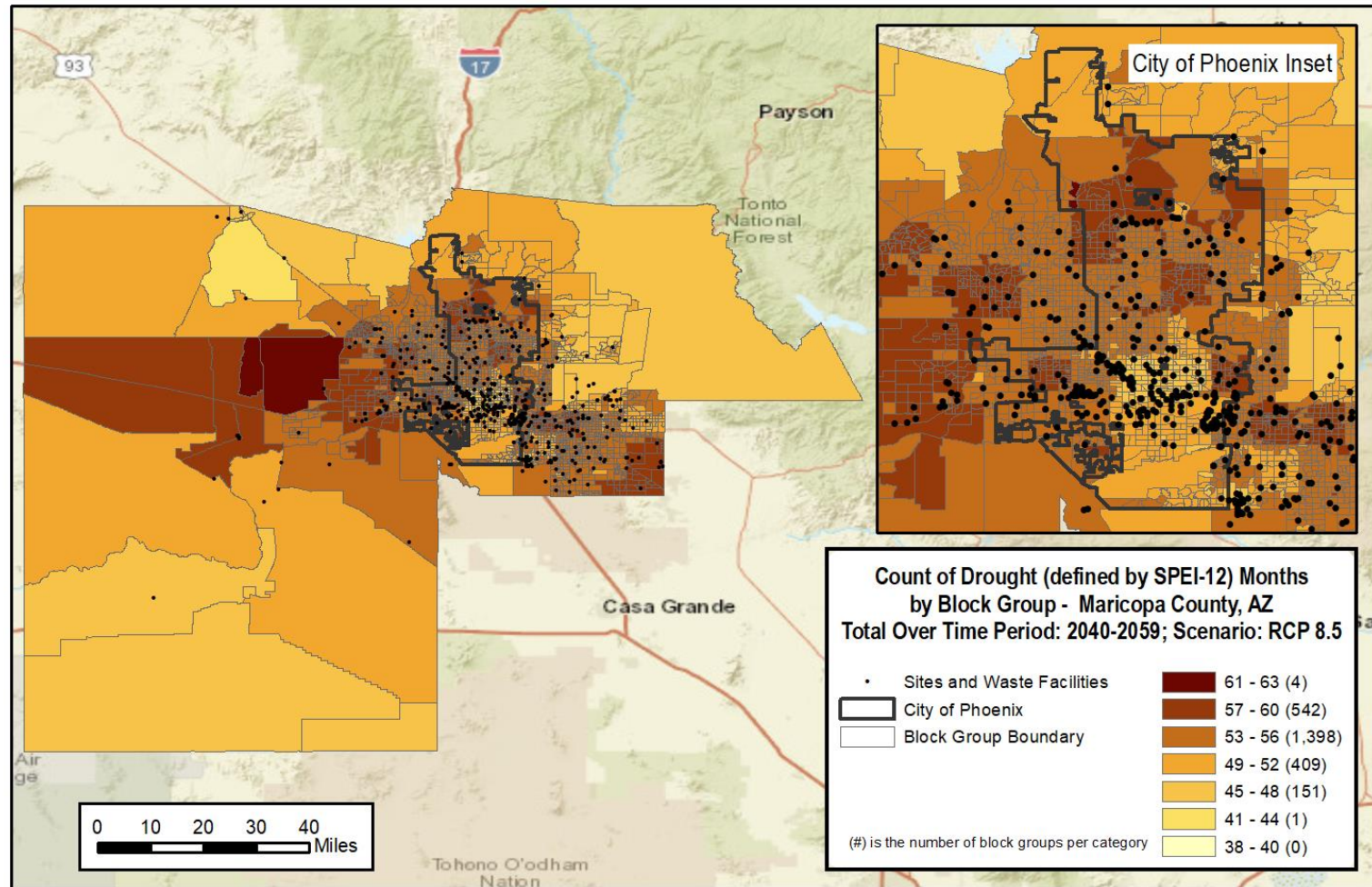
Drought: Count of Drought (Defined by SPEI-12) Months, by Block Group Historical (Total Over 1986-2005)



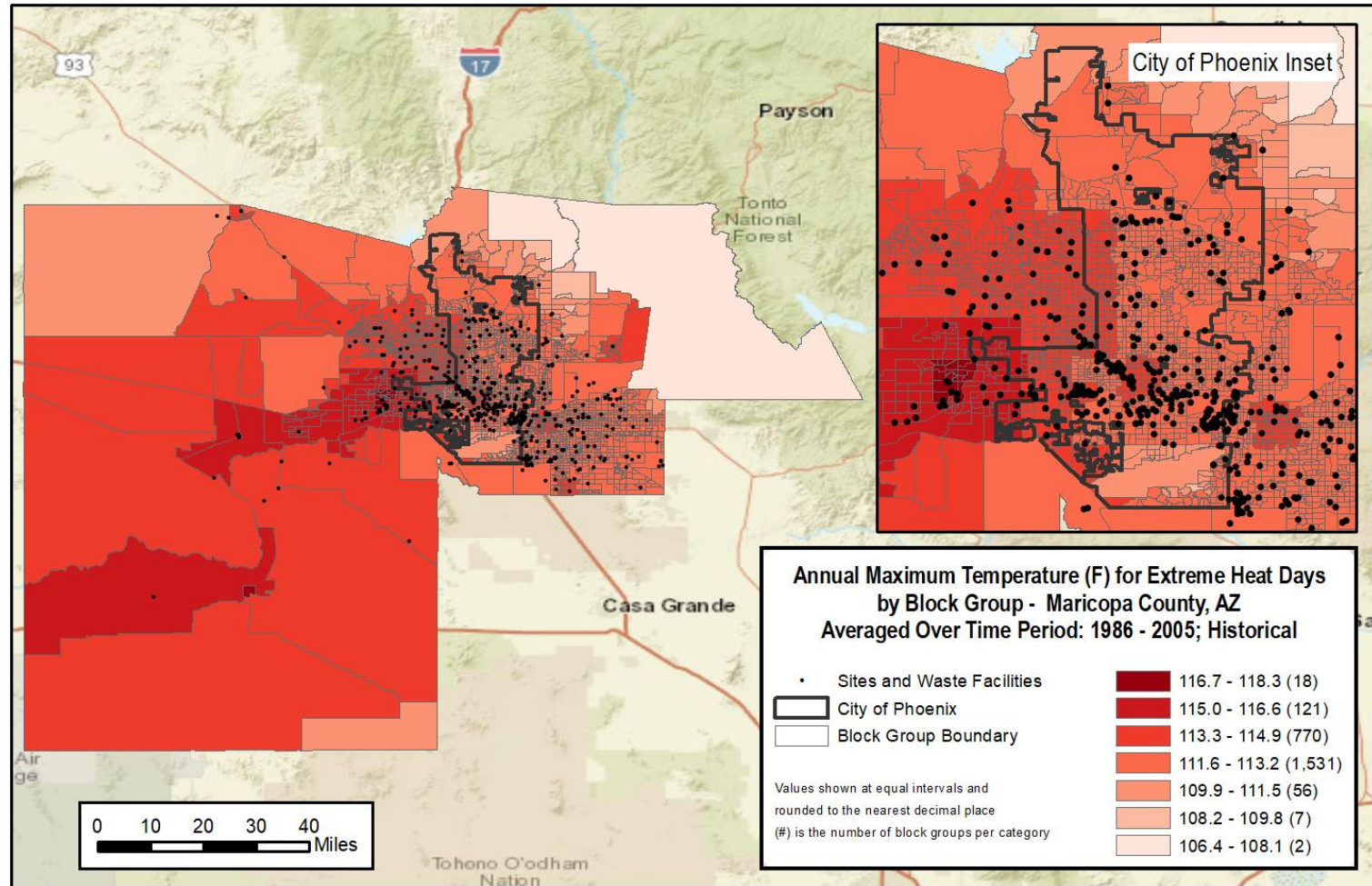
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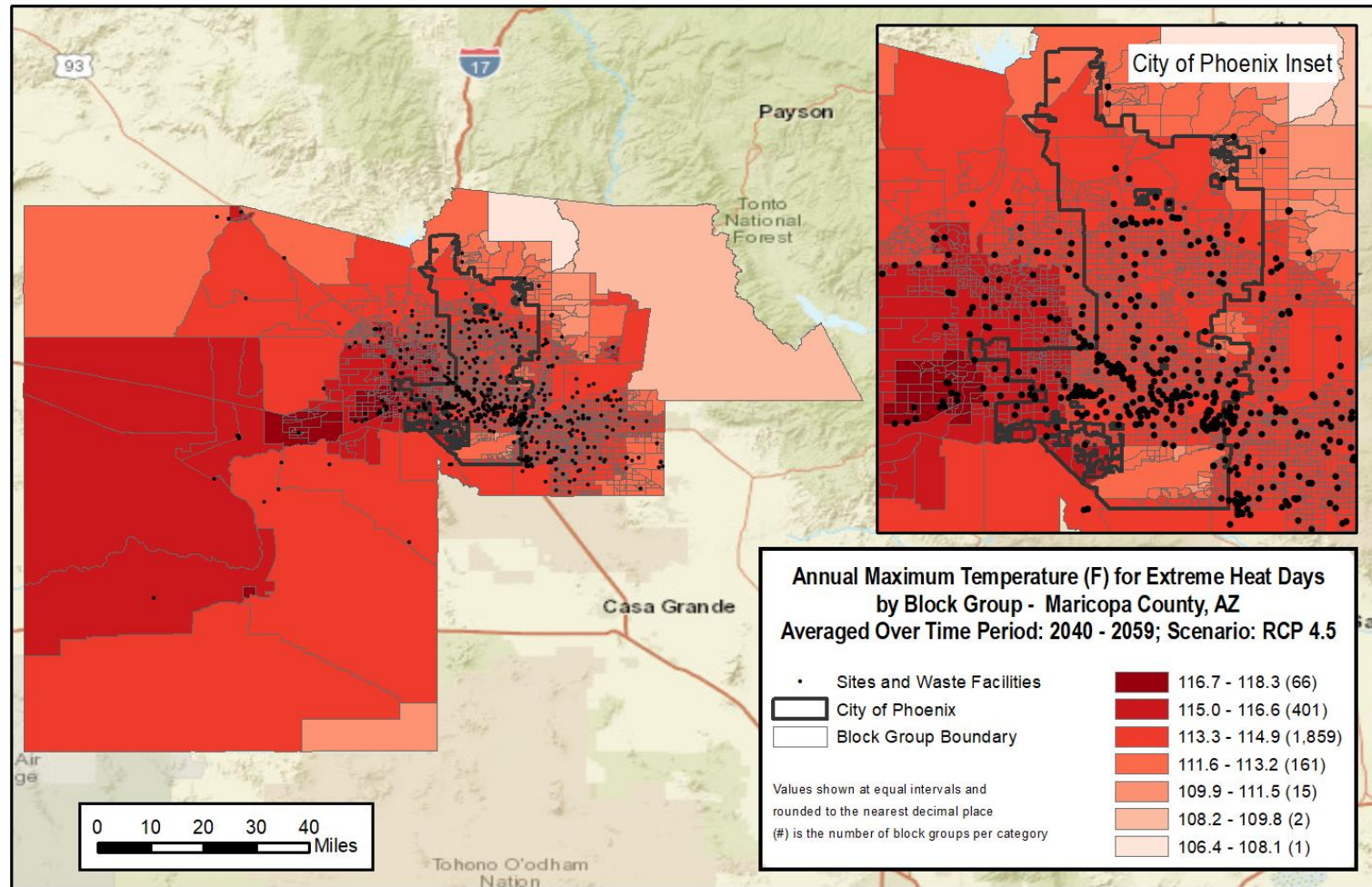


Annual Maximum Temperature for Extreme Heat Days*, by Block Group Historical (Averaged Over 1986-2005)



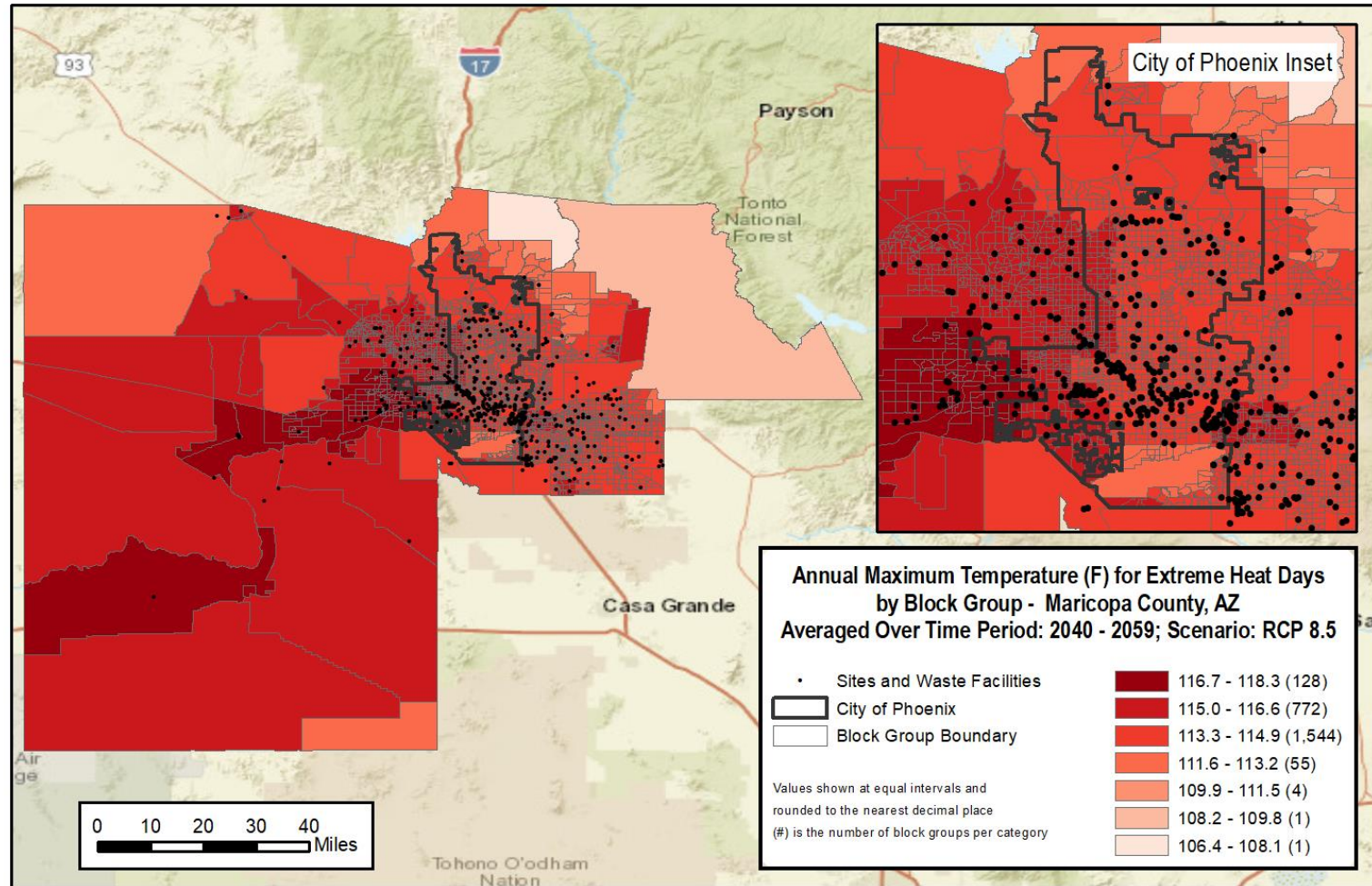
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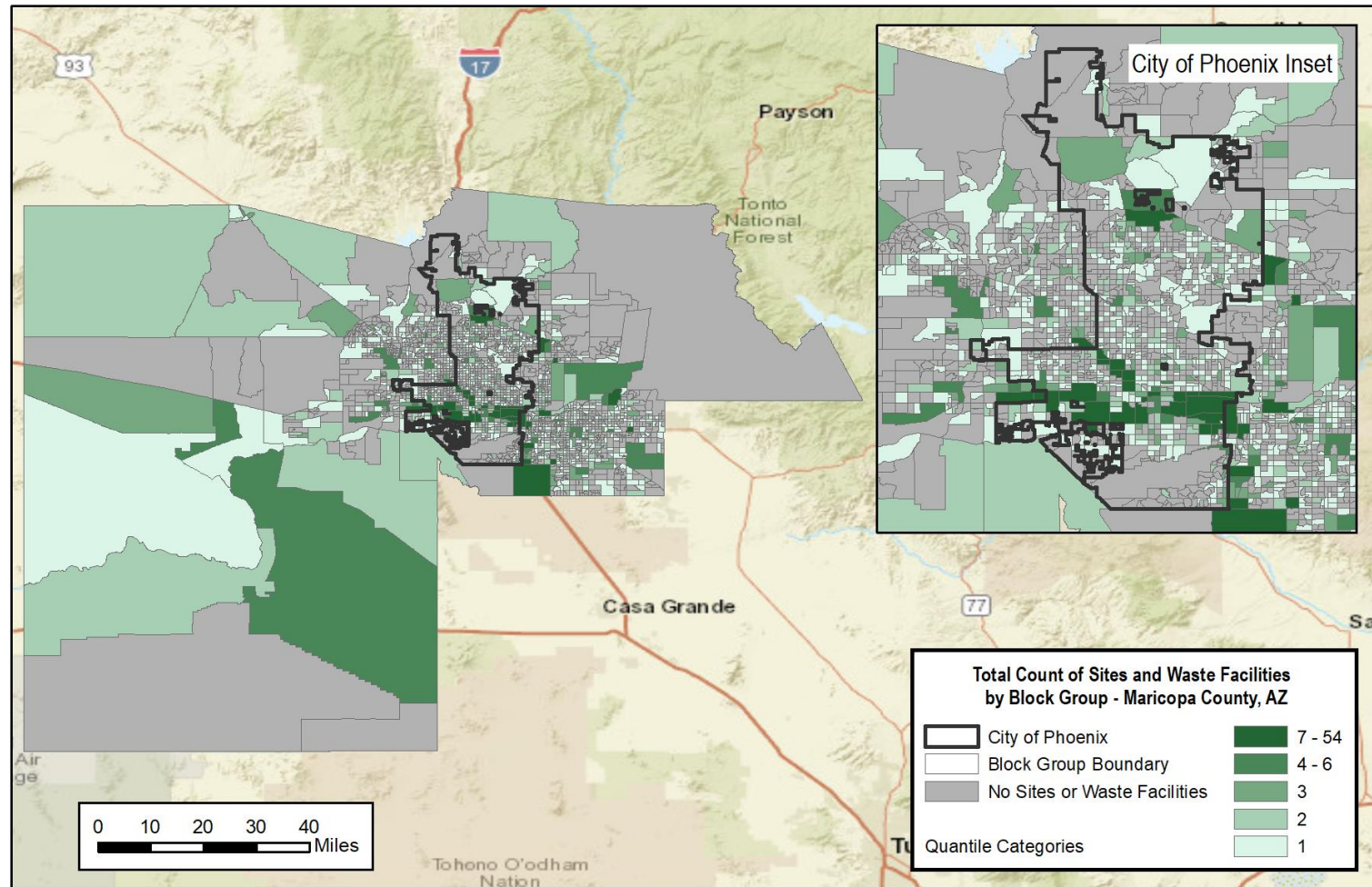


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Summary of Site and Waste Facility Data: Data Sources; Facility Counts

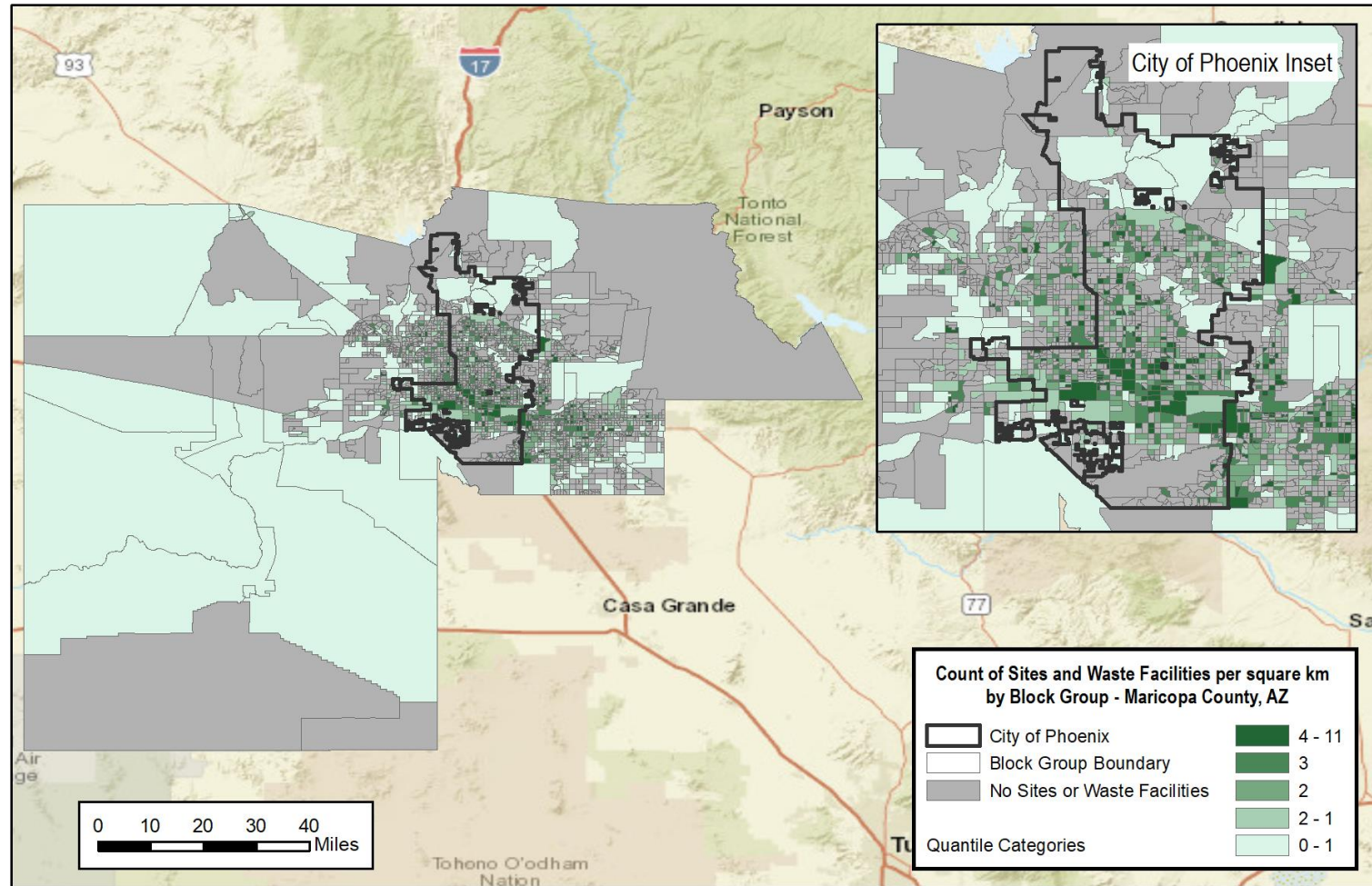
Site Type			R9	% of Total
Data Source(s)				
Hazardous Waste	1. Generators	FRS; RCRA (API); BRS	351	19%
	2. TSDFs	FRS; RCRA (API)	9	<1%
	3. Transporters	FRS; RCRA (API)	76	4%
	4. Transfer Facilities	FRS; RCRA (API)	1	<1%
	5. Other Operators	FRS; RCRA (API)	65	4%
Cleanup	6. Corrective Action	FRS; RCRA (API)	12	<1%
	7. Brownfields	FRS; CIMC; CT DEEP	31	2%
	8. Superfund (NPL)	FRS; SEMS	5	<1%
	9. Non-NPL	FRS; SEMS	21	1%
	10. Removal/Emergency Response Sites	OSRR EPRB	0	<1%
Other	11. Fuel Terminals & Oil Spill Response/ Prevention	FRS; OSRR EPRB	18	<1%
	12. Incident Waste Facilities	I-Waste	15	<1%
	13. Solid Waste Landfills (Nonhazardous)	FRS; CT Landfill List; GHGRP; AZURITE	19	1%
	14. Petroleum Storage Tanks		1207	
	a. USTs	FRS; CT UST List; AZ UST Database	1207	66%
	b. ASTs	Tier 1 & Tier 2 AST (Provided by R1)	0	N/A
	15. Other (RMP)	FRS	0	N/A
Total			1830	
Total (Excluding Petroleum Storage Tanks)			623	

Total Count of Sites and Waste Facilities, by Block Group



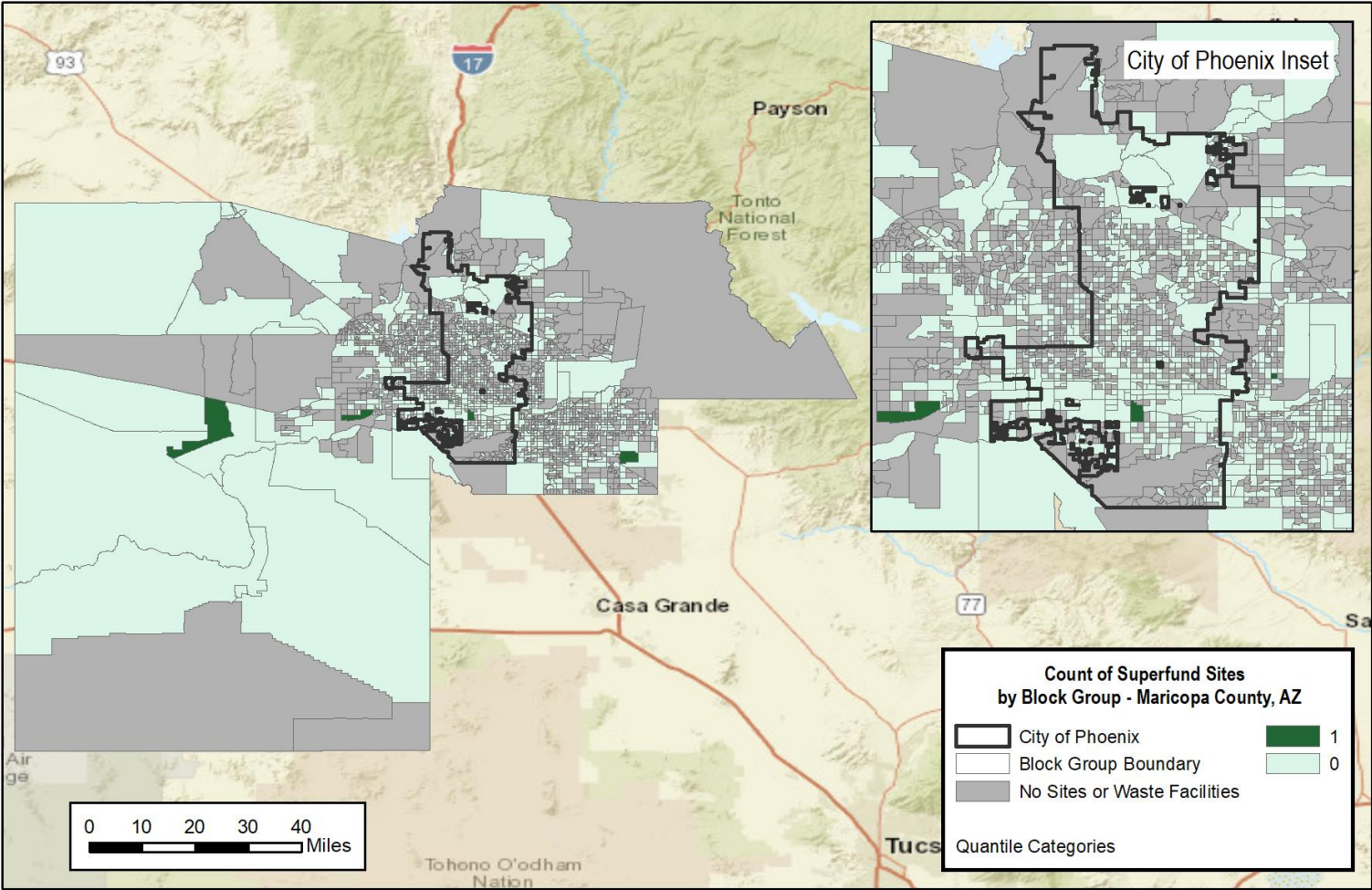
- Counts tend to be higher along highway Block Groups
- Not all Block Groups contain facilities (Grayed Block Groups), BUT impact will depend on downwind/downstream characteristics: Important to look at fate and transport indicators (later slides)

Count of Sites and Waste Facilities Per Square Kilometer, by Block Group

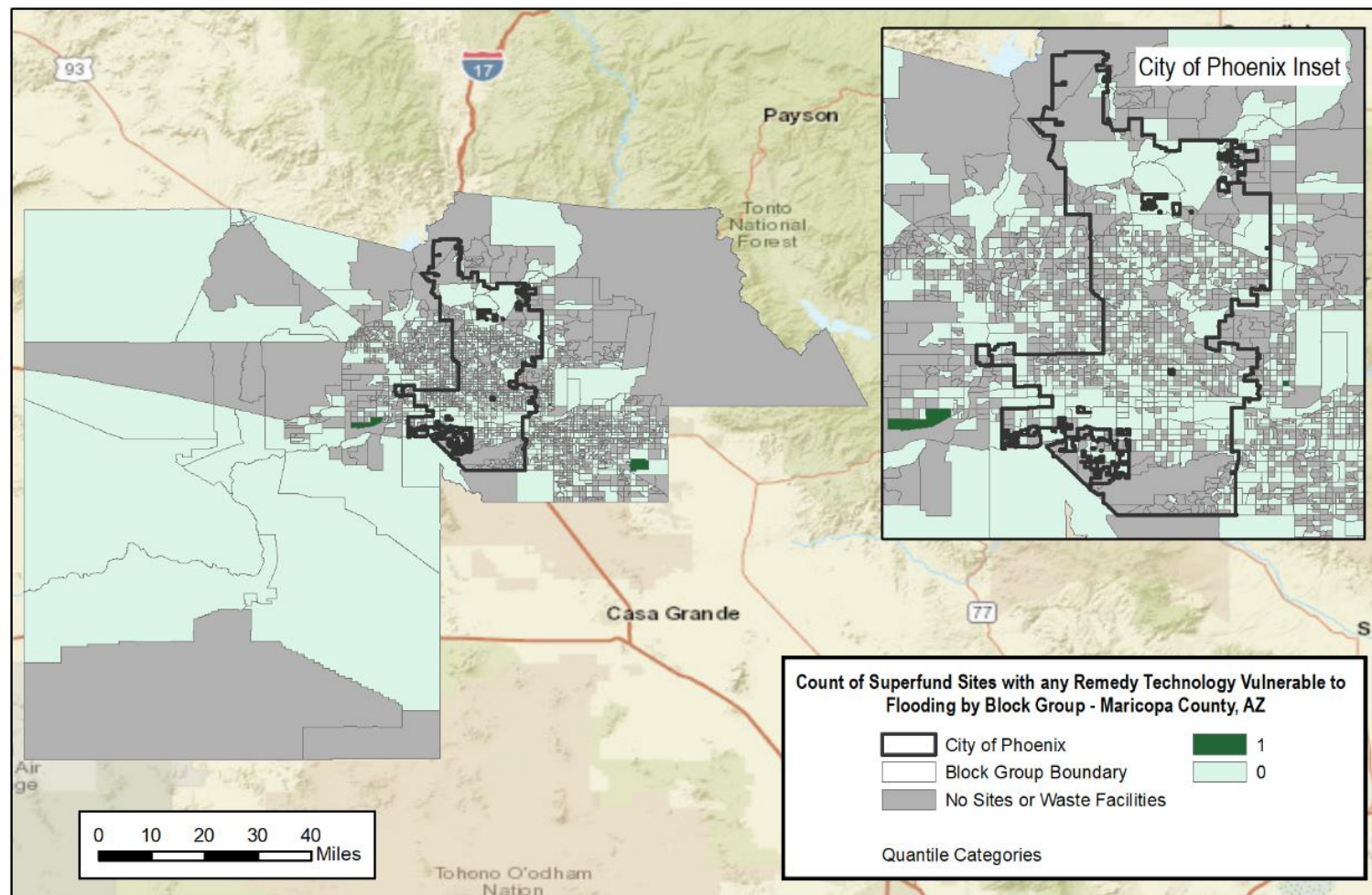


Density patterns are similar to total counts (e.g., higher along highways)

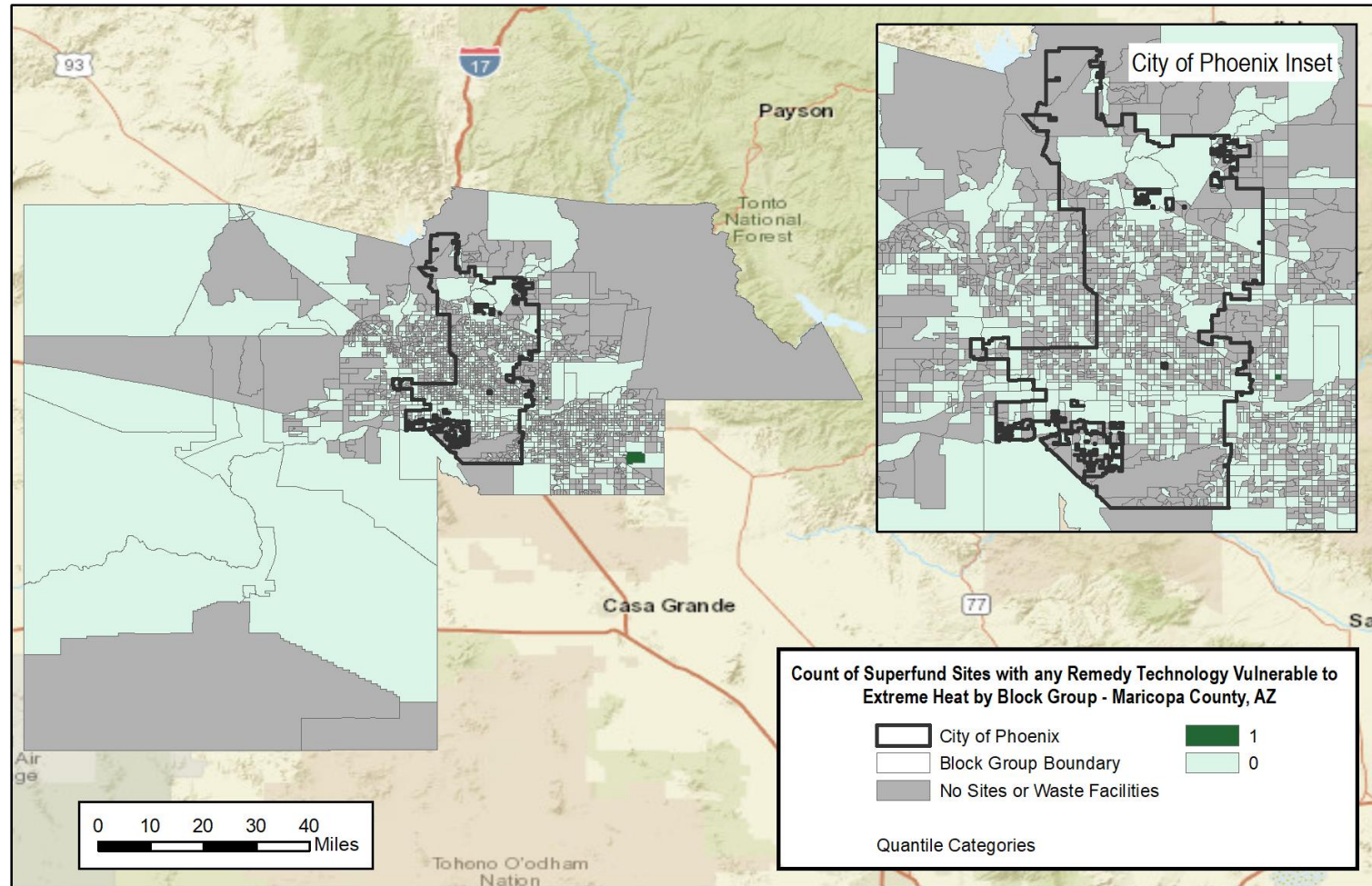
Count of Superfund Sites



Count of Superfund Sites With Any Remedy Technology Vulnerable to Each Extreme Event, By Block Group

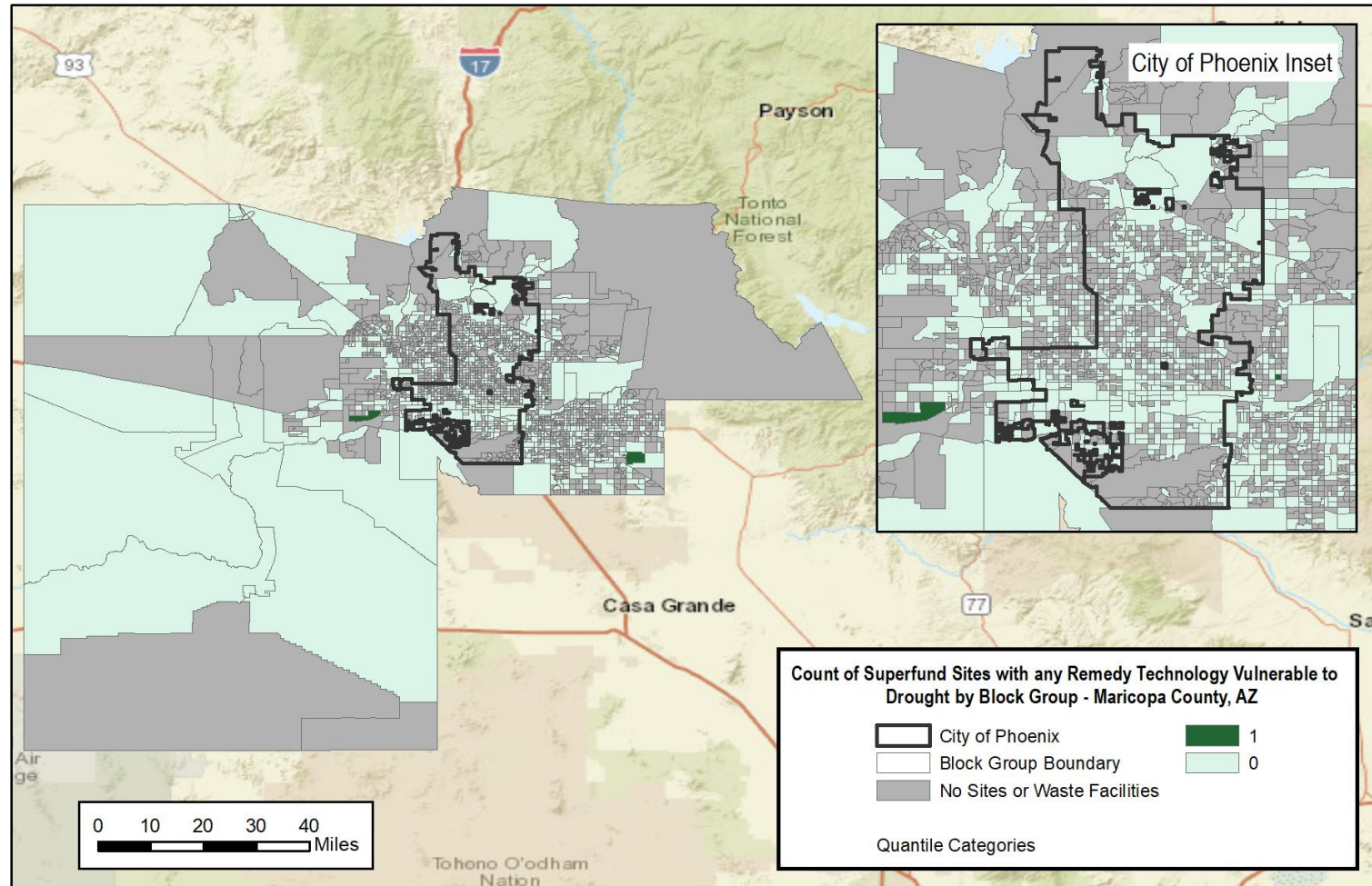


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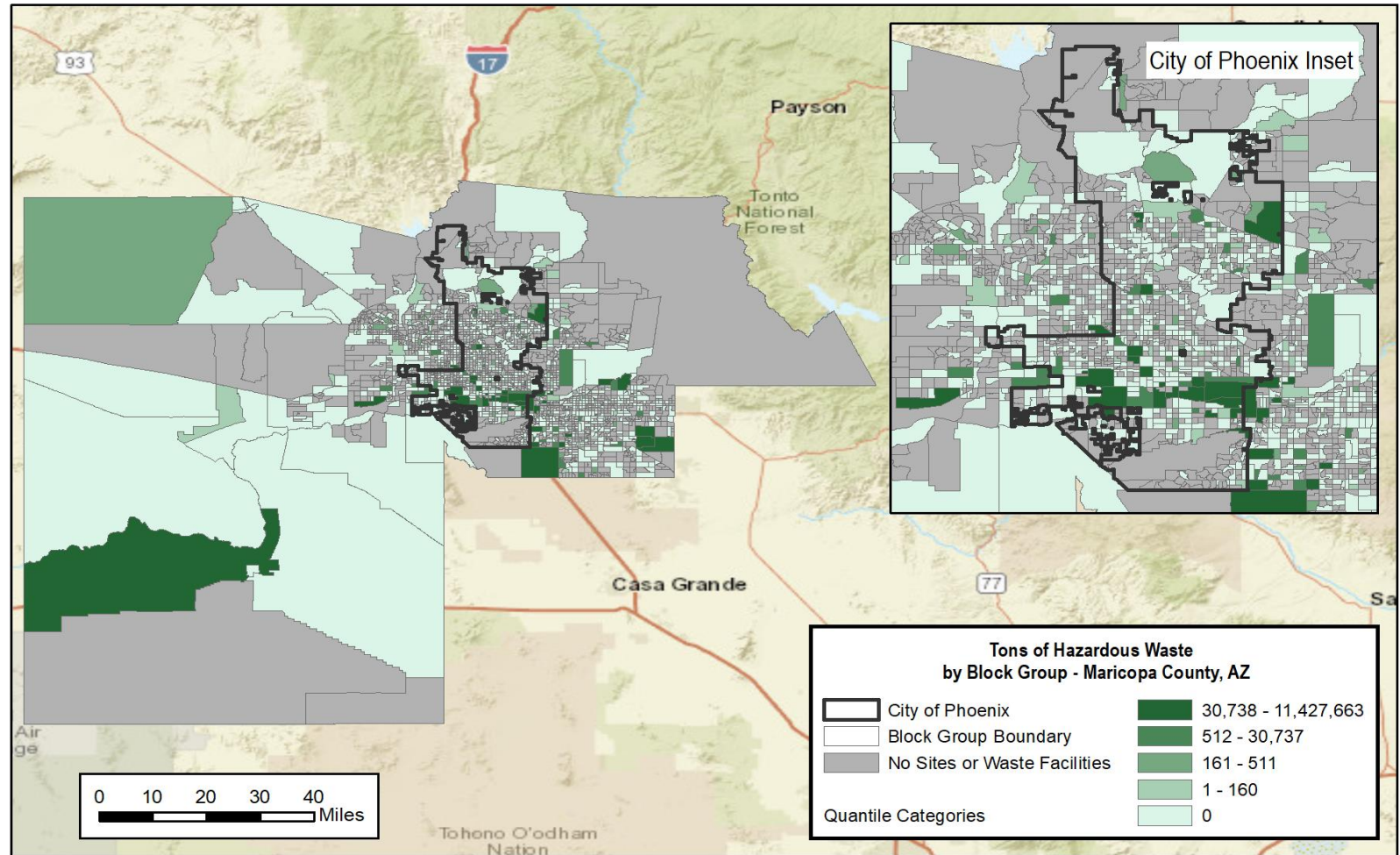
At least one block group in Maricopa was identified to contain vulnerable technologies to each extreme event type.

Count of Superfund Sites With Any Remedy Technology Vulnerable to Each Extreme Event, By Block Group



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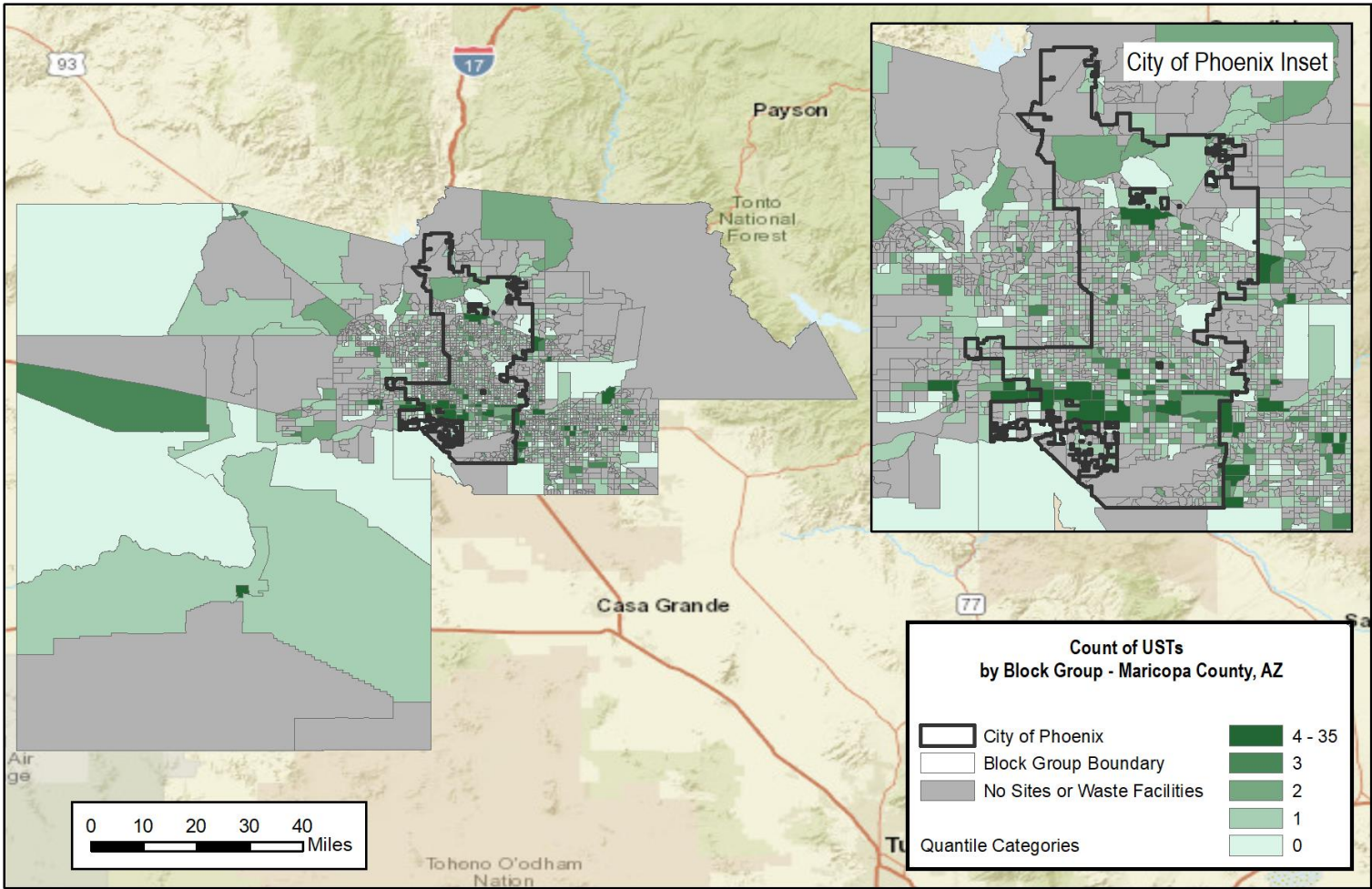
Tons of Hazardous Waste, by Block Group



- 14 Block Groups contain ~90% of Maricopa's hazardous waste
- Hazard "Types": Ignitable, Toxic, Acutely Hazardous, Corrosive, Reactive, Toxicity Characteristic *

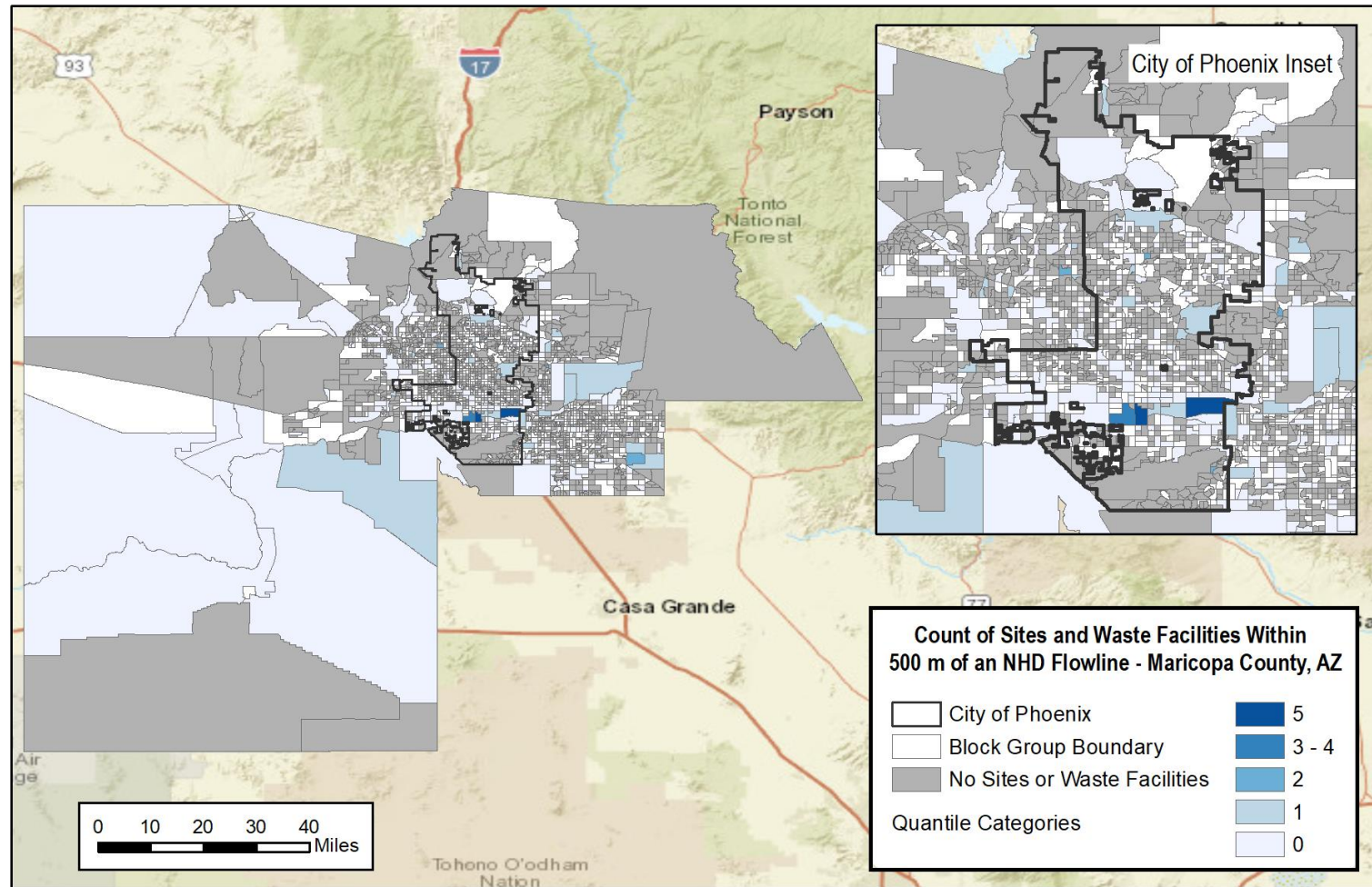
*Definition of Types: <https://www.epa.gov/hw/defining-hazardous-waste-listed-characteristic-and-mixed-radiological-wastes>

Counts of Underground Storage Tanks, by Block Group

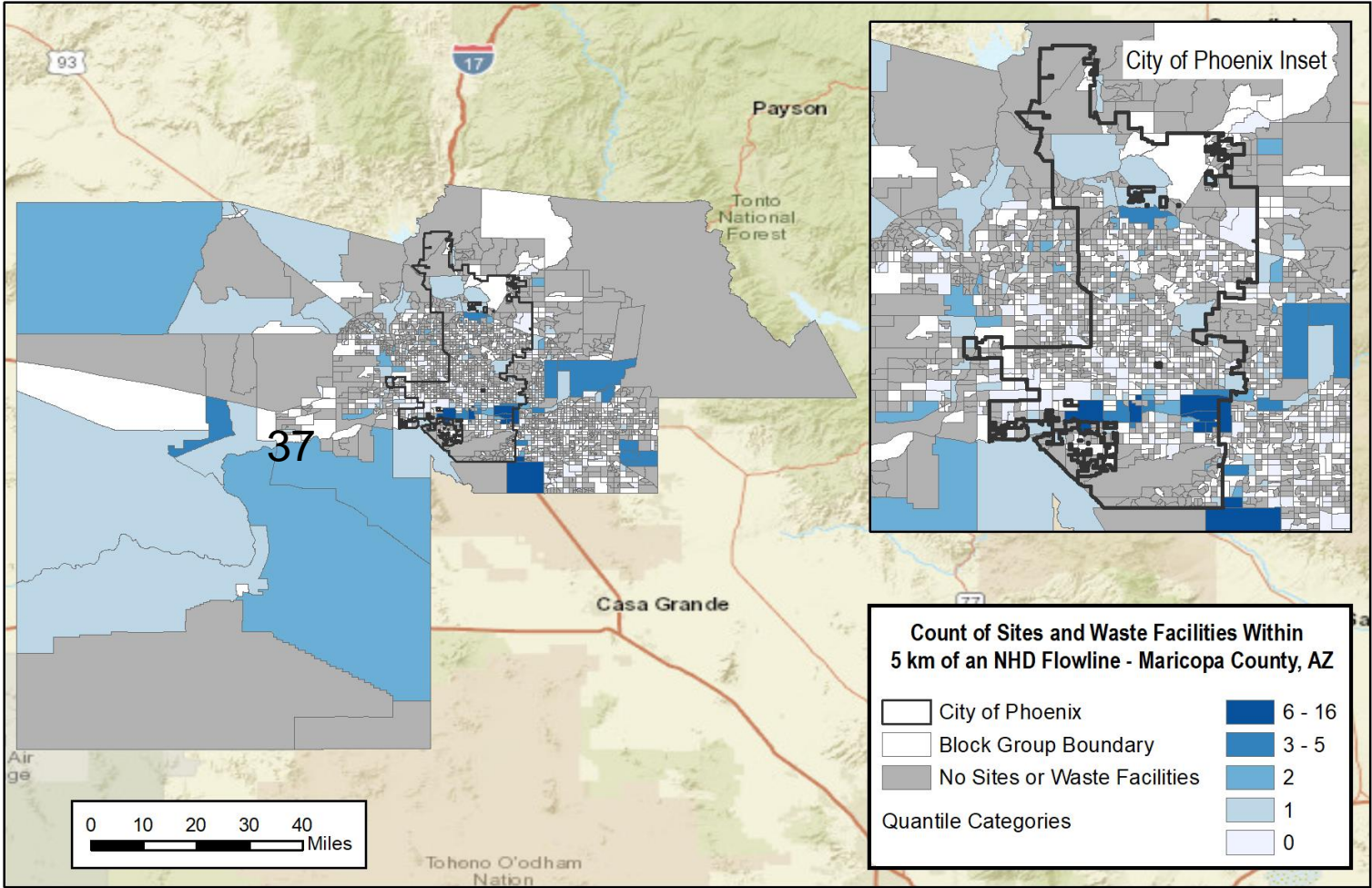


No data available on ASTs in Maricopa County

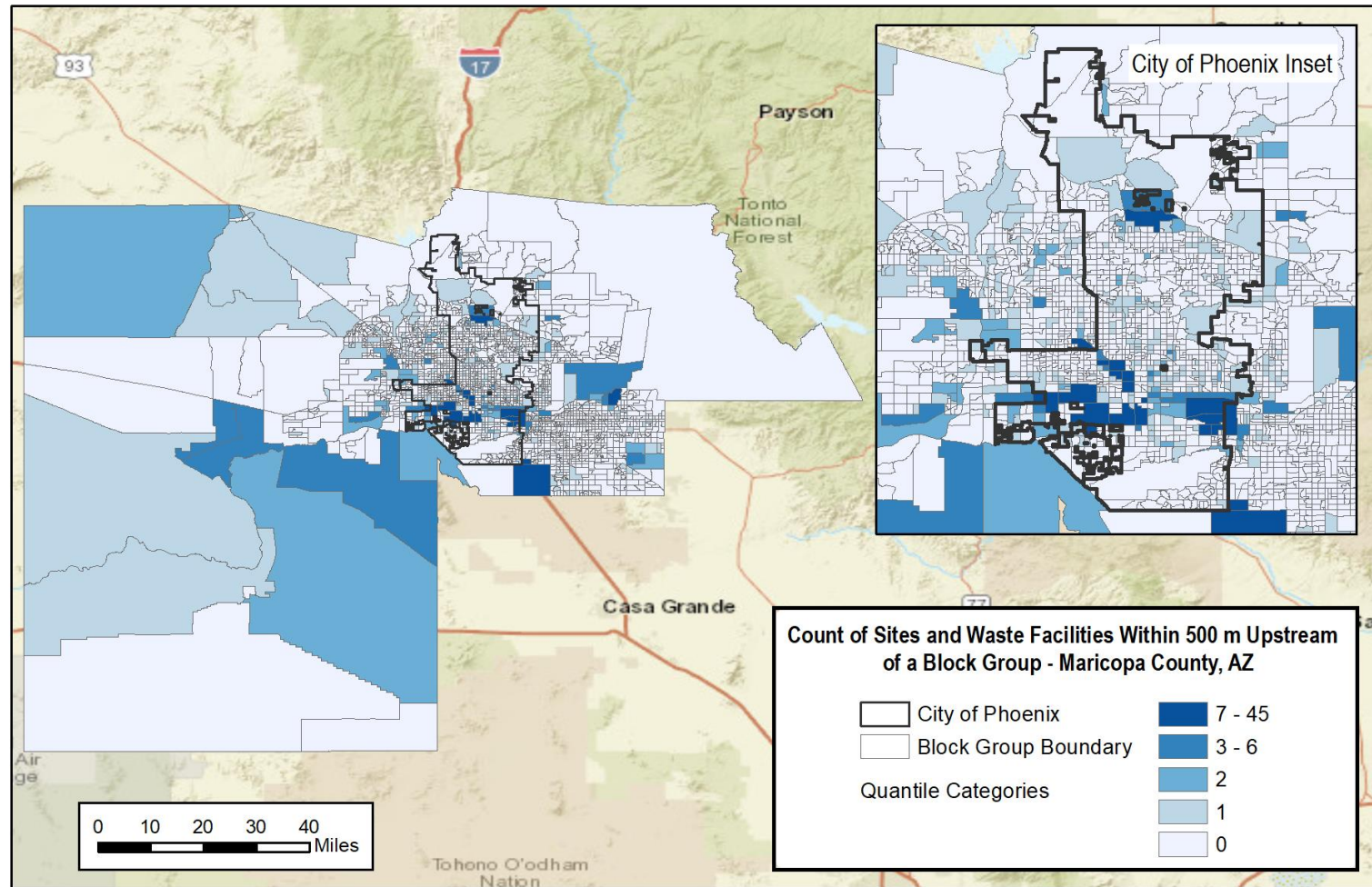
Count of Sites/Facilities Within a Specific Distance of a Flowline



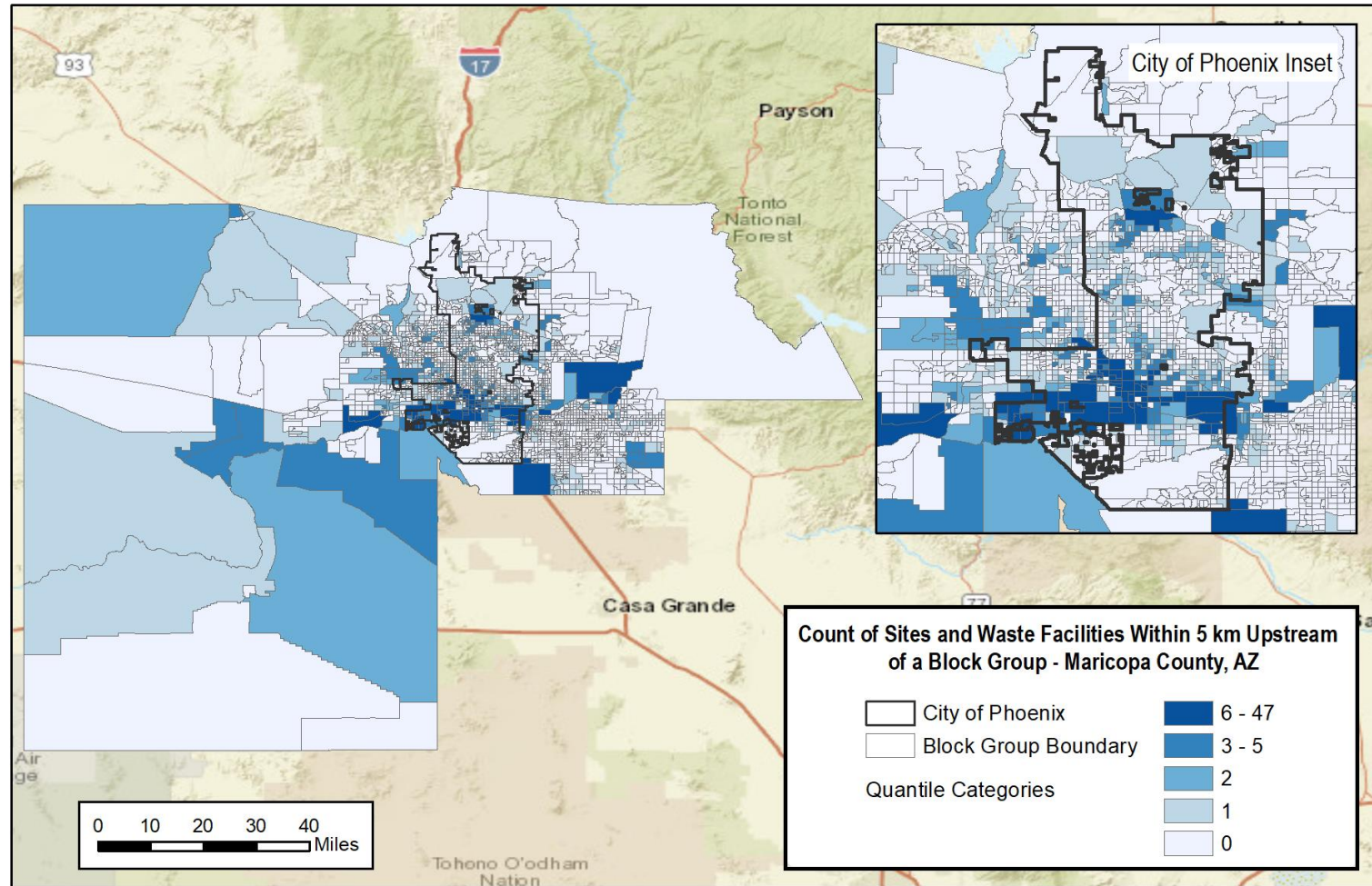
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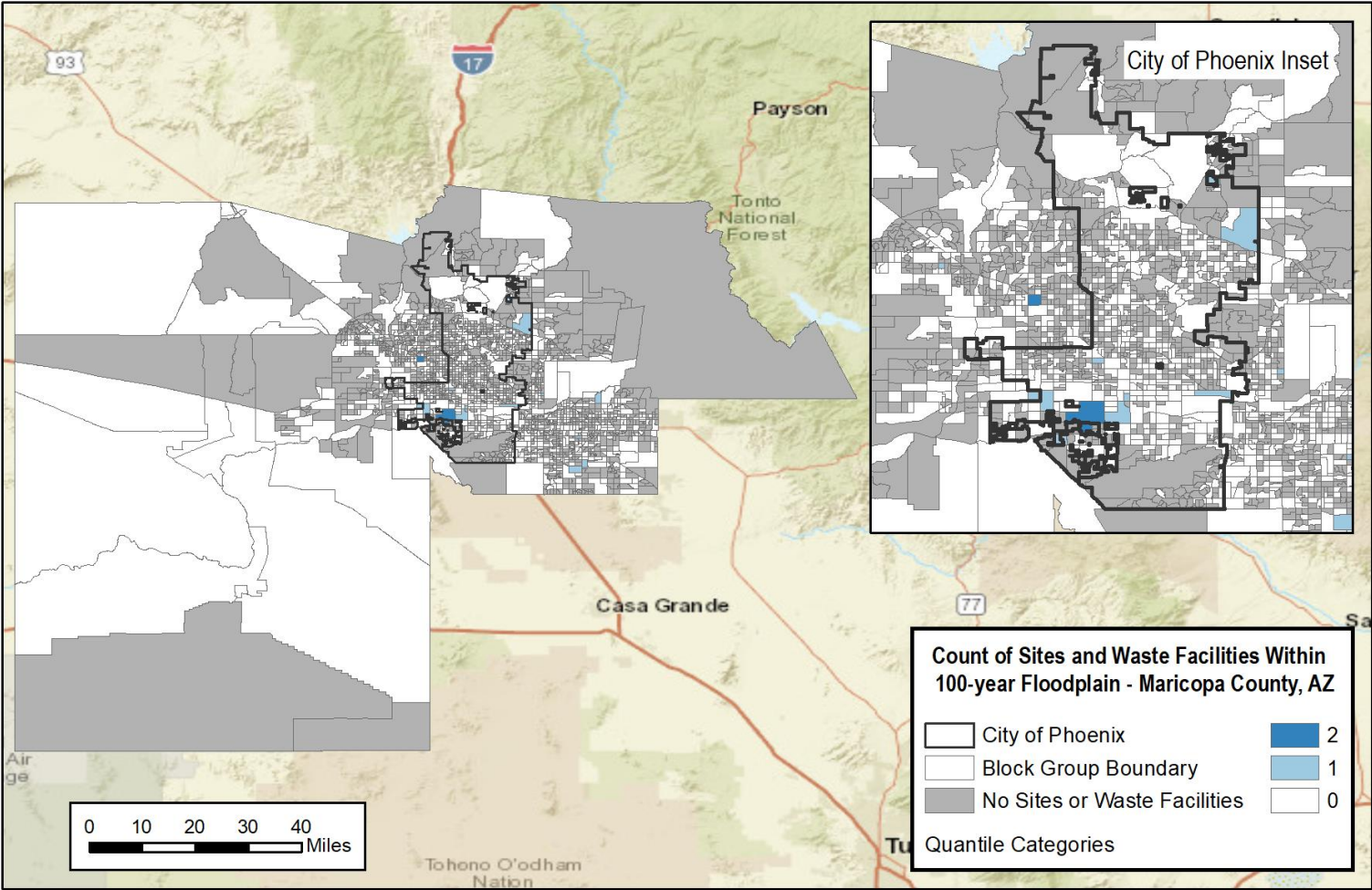
Count of Sites/Facilities Within a Specific Upstream Distance of Block Group



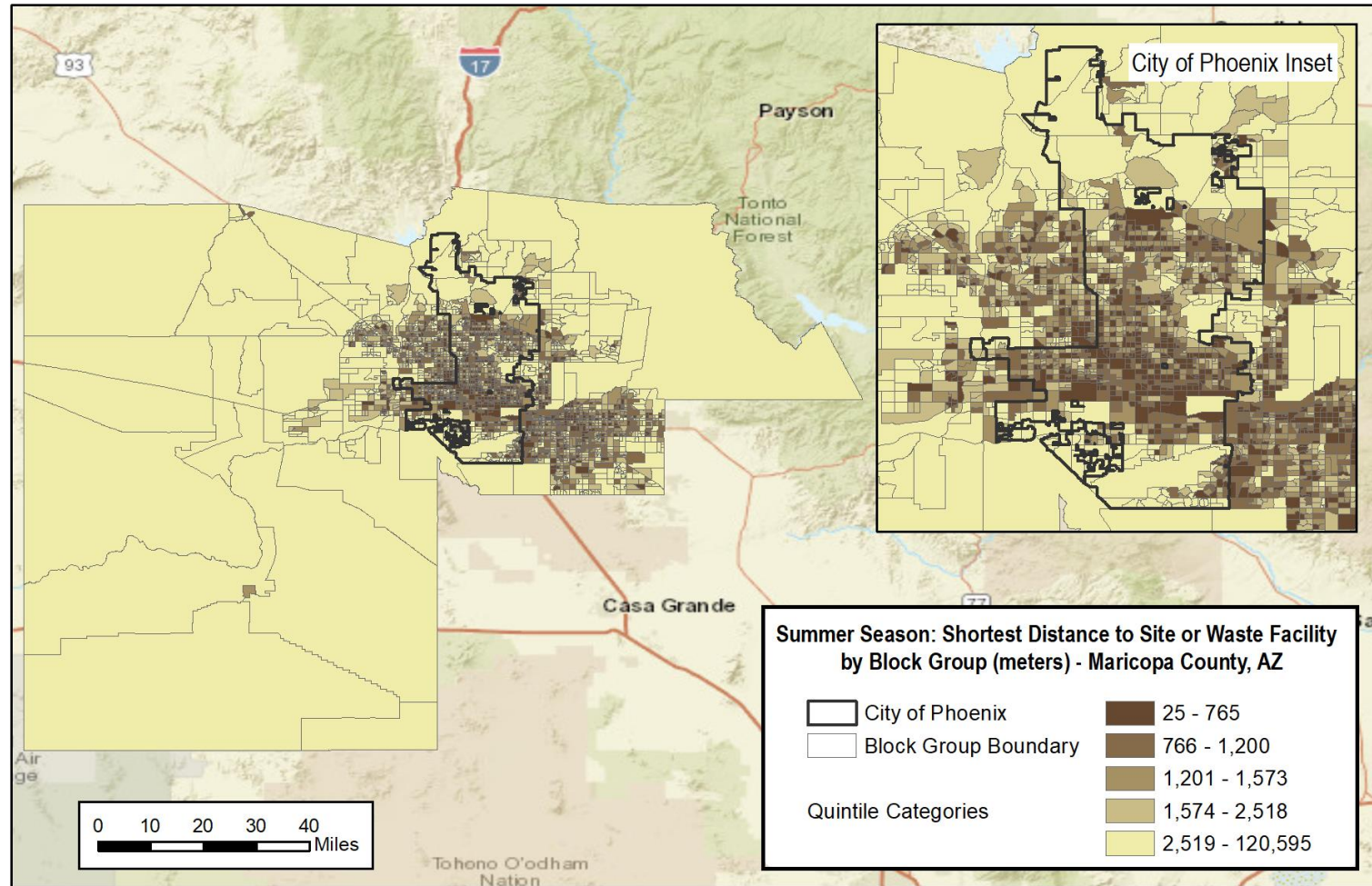
Count of Sites/Facilities Within a Specific Upstream Distance of Block Group



Count of Sites/Facilities Within 100-Year Floodplain

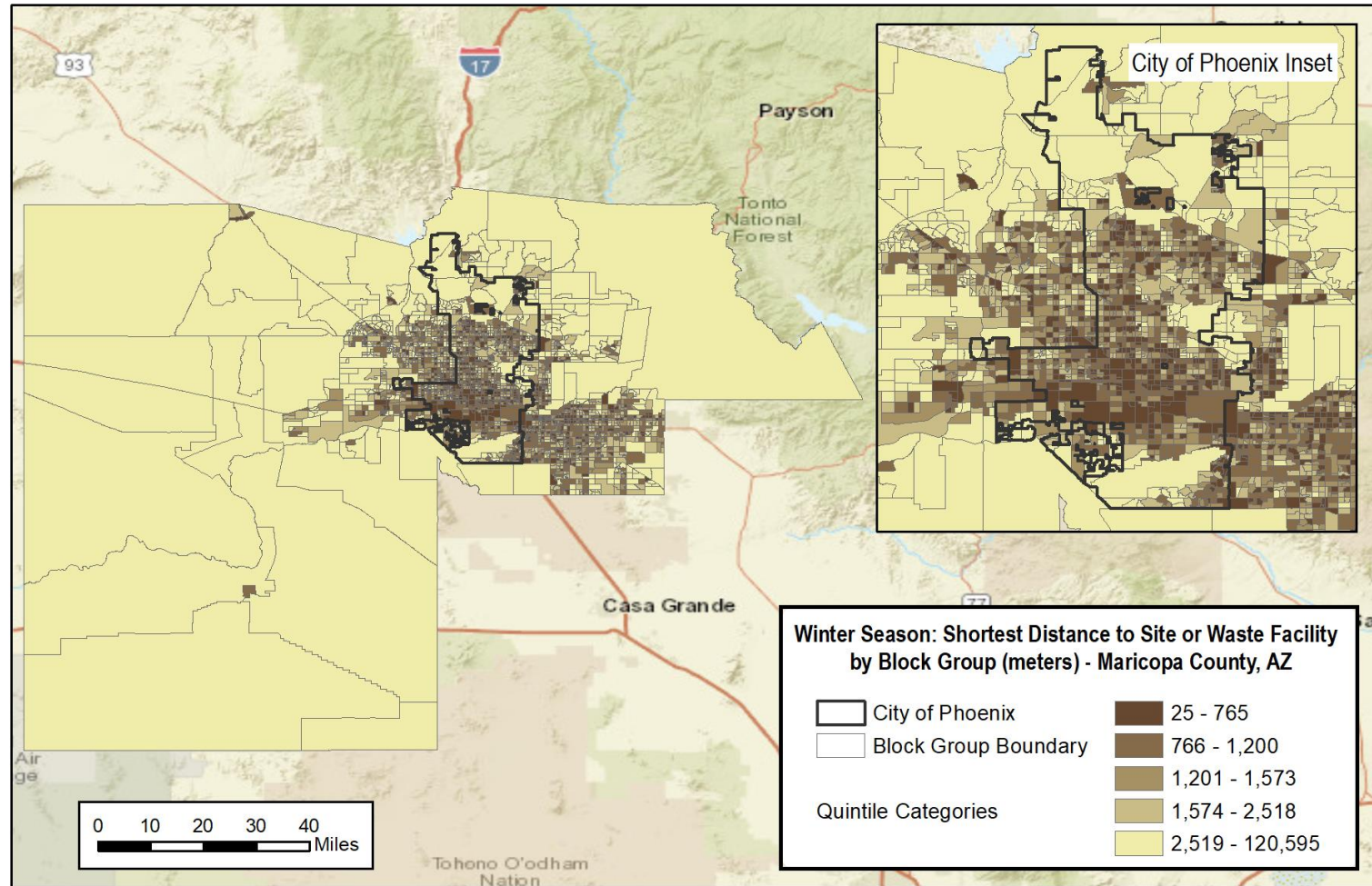


Shortest Upwind Distance to a Site/Facility by Block Group: Summer Season



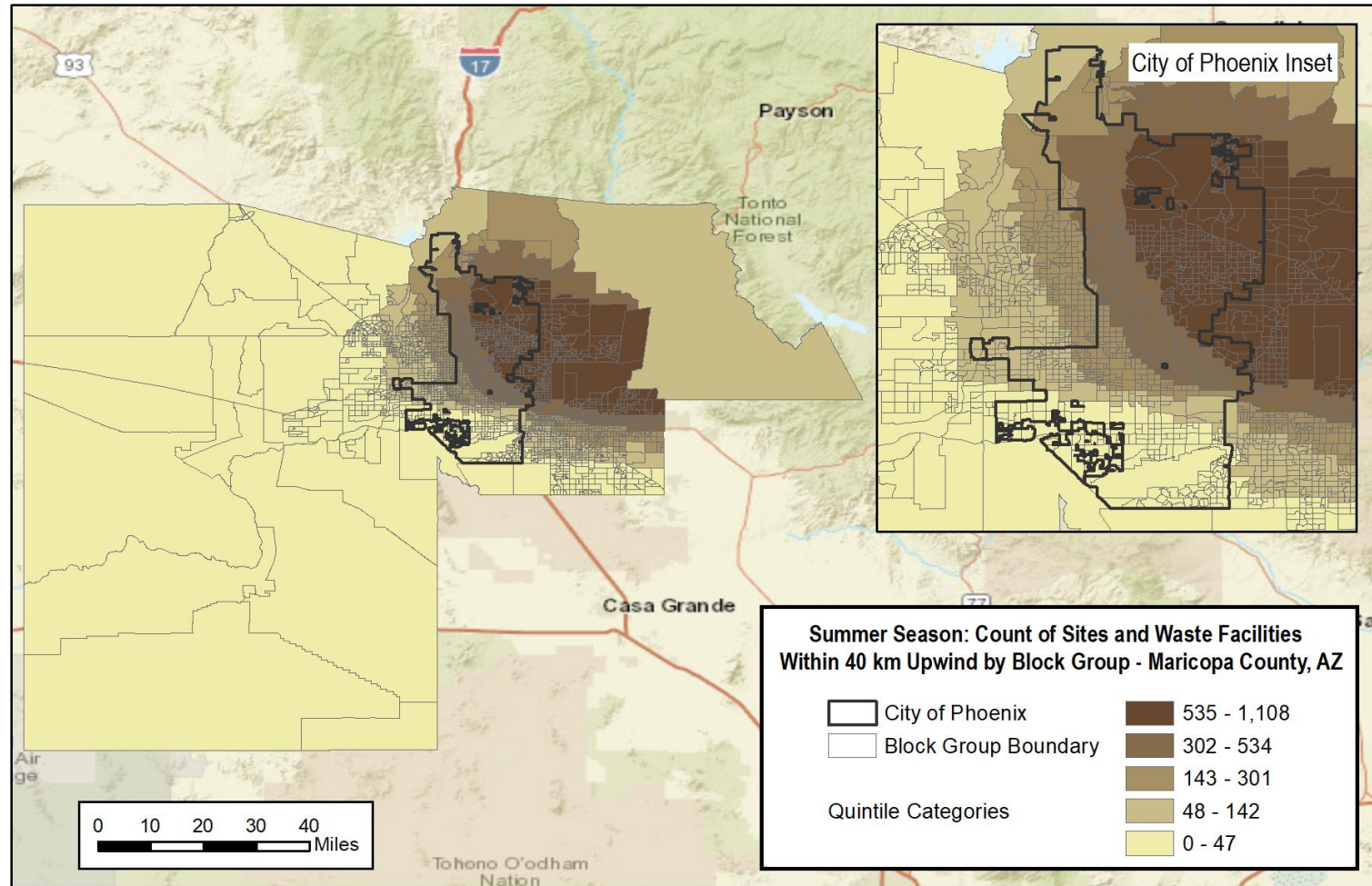
Map shows lower (more risky) distances in darker colors

Shortest Upwind Distance to a Site/Facility by Block Group: Winter Season

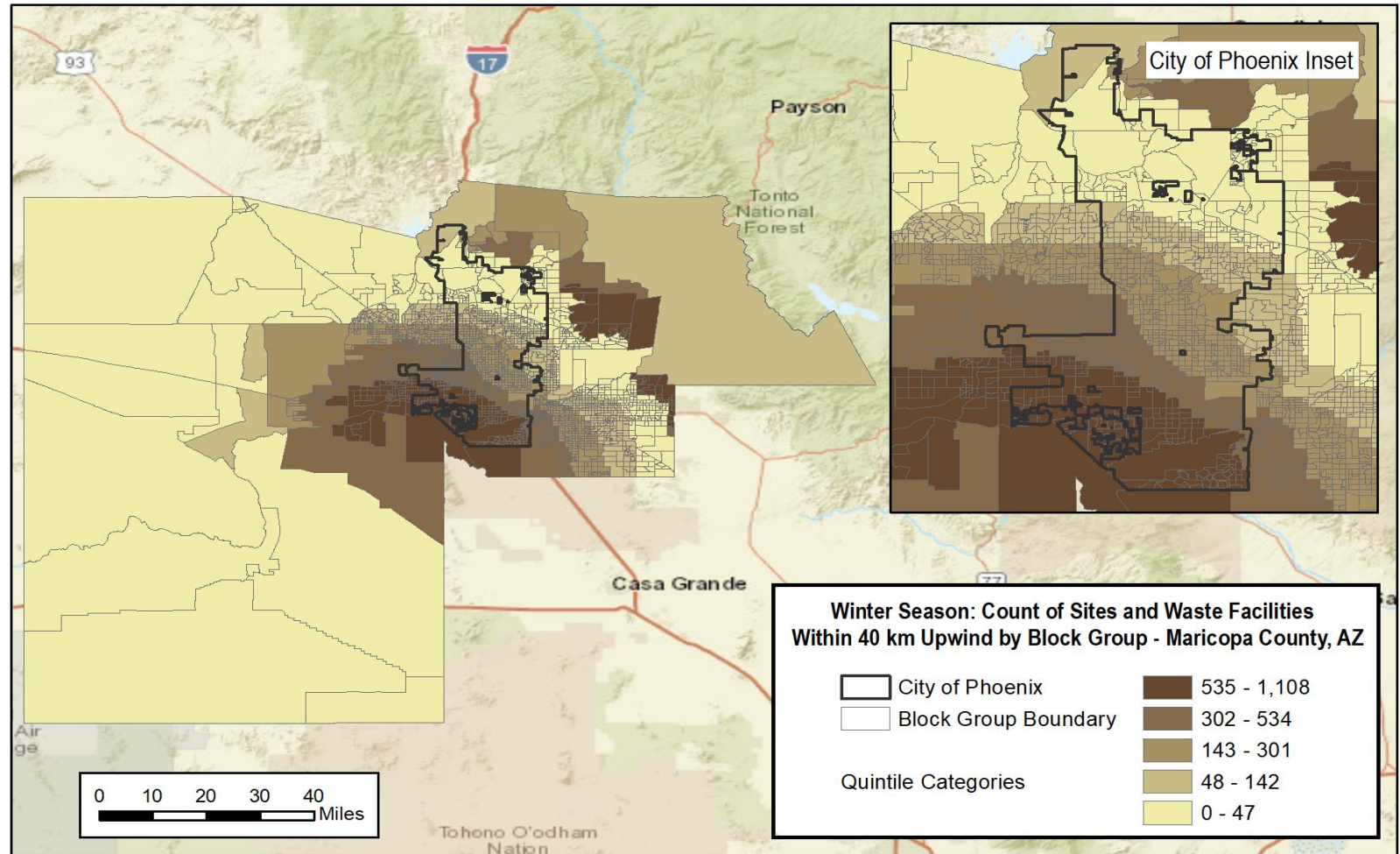


- Map shows lower response times (more risky) distances in darker colors
- Maps for other seasons included in appendix

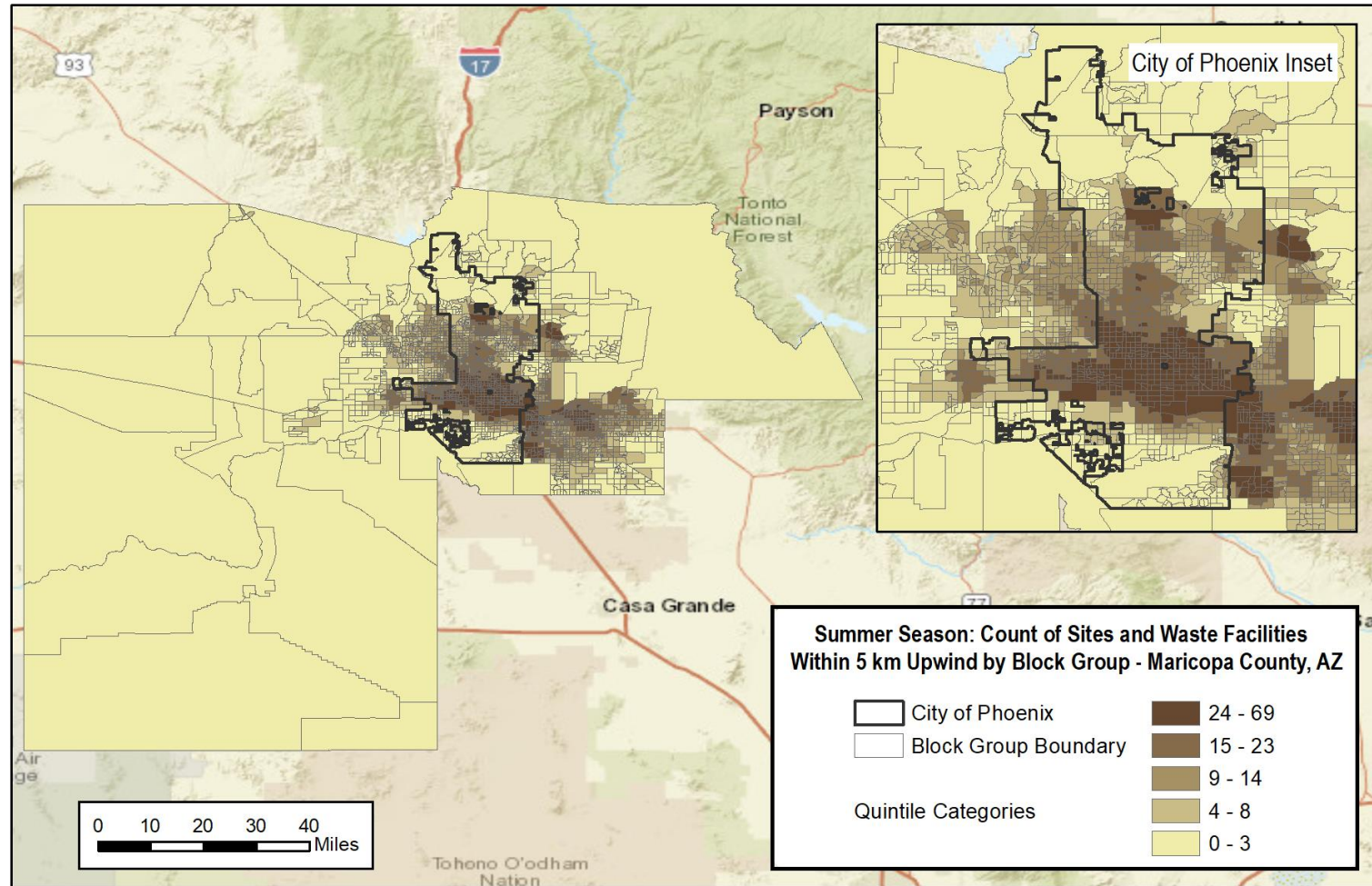
Count of Sites/Facilities Within a Specific Upwind Distance of a Block Group: Summer Season



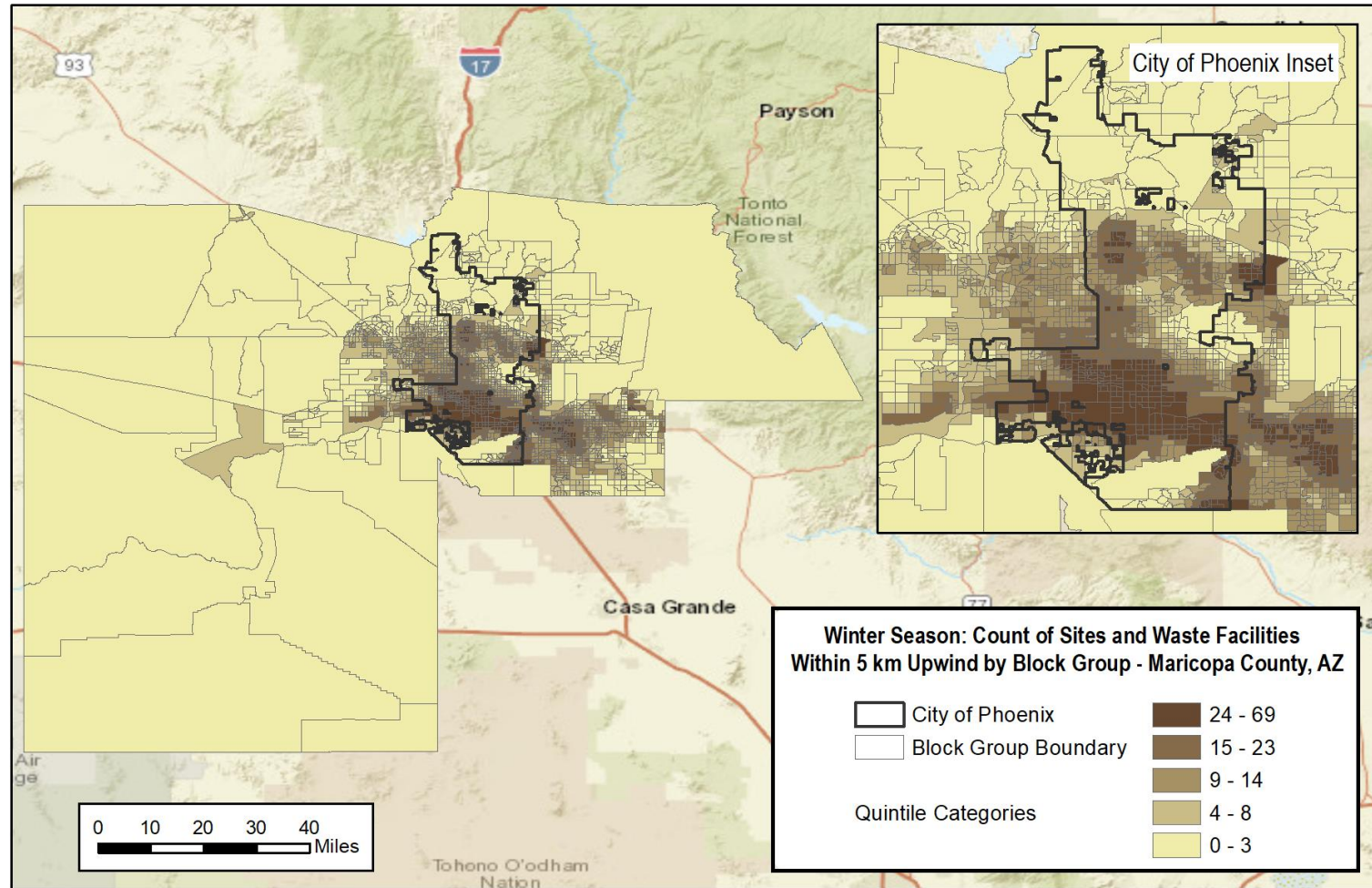
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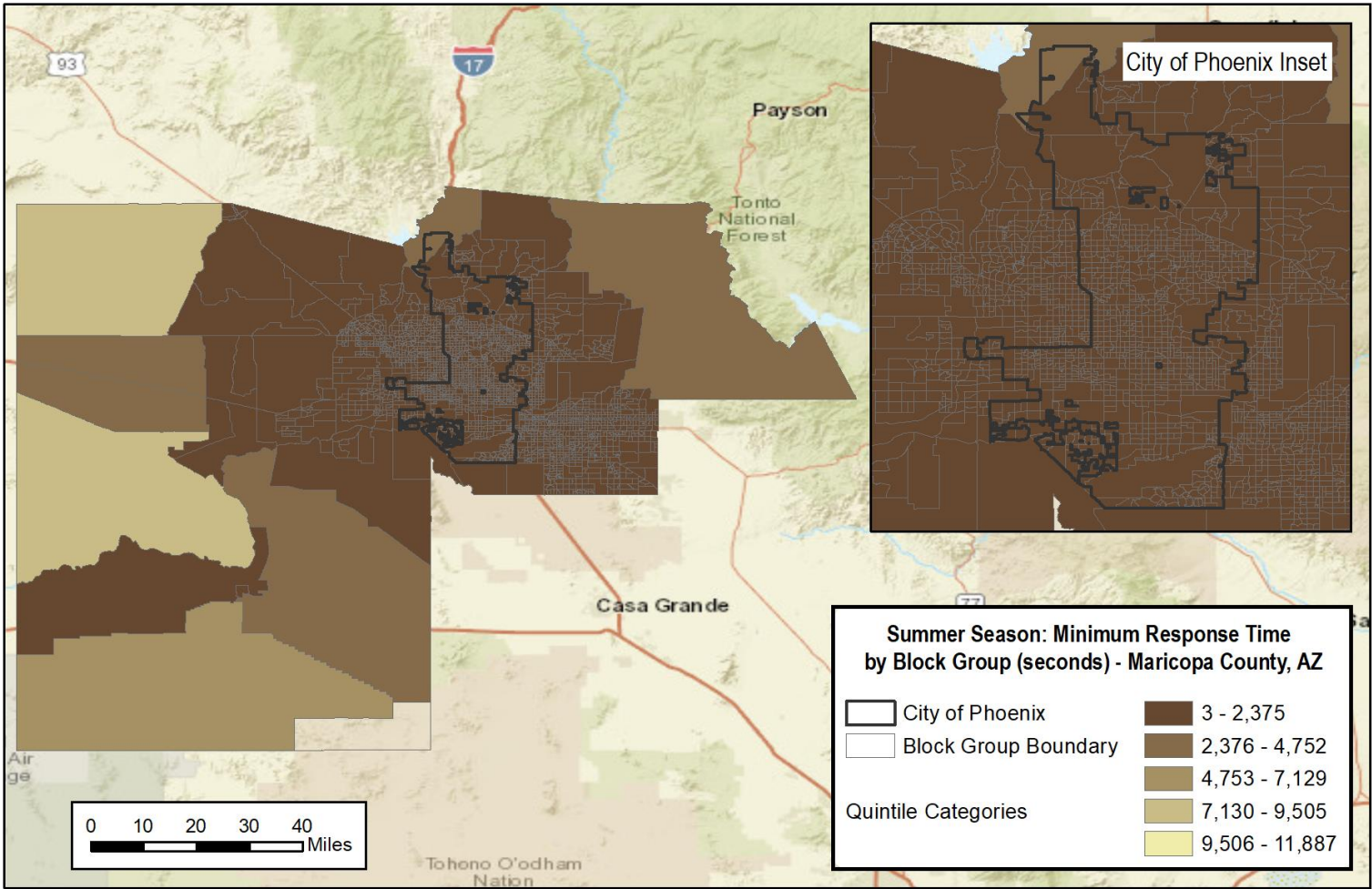
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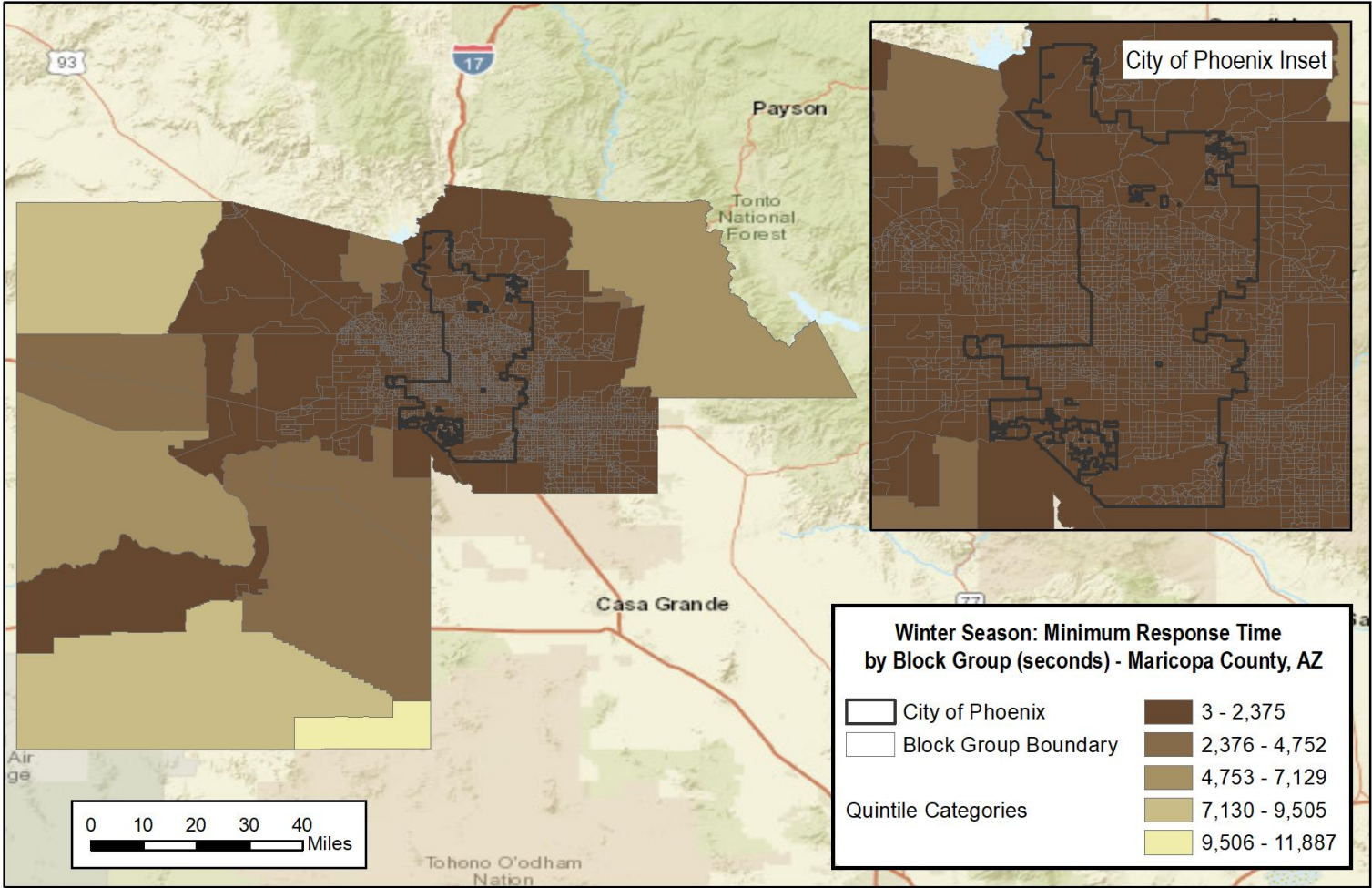


Minimum Response Time by Block Group: Summer Season



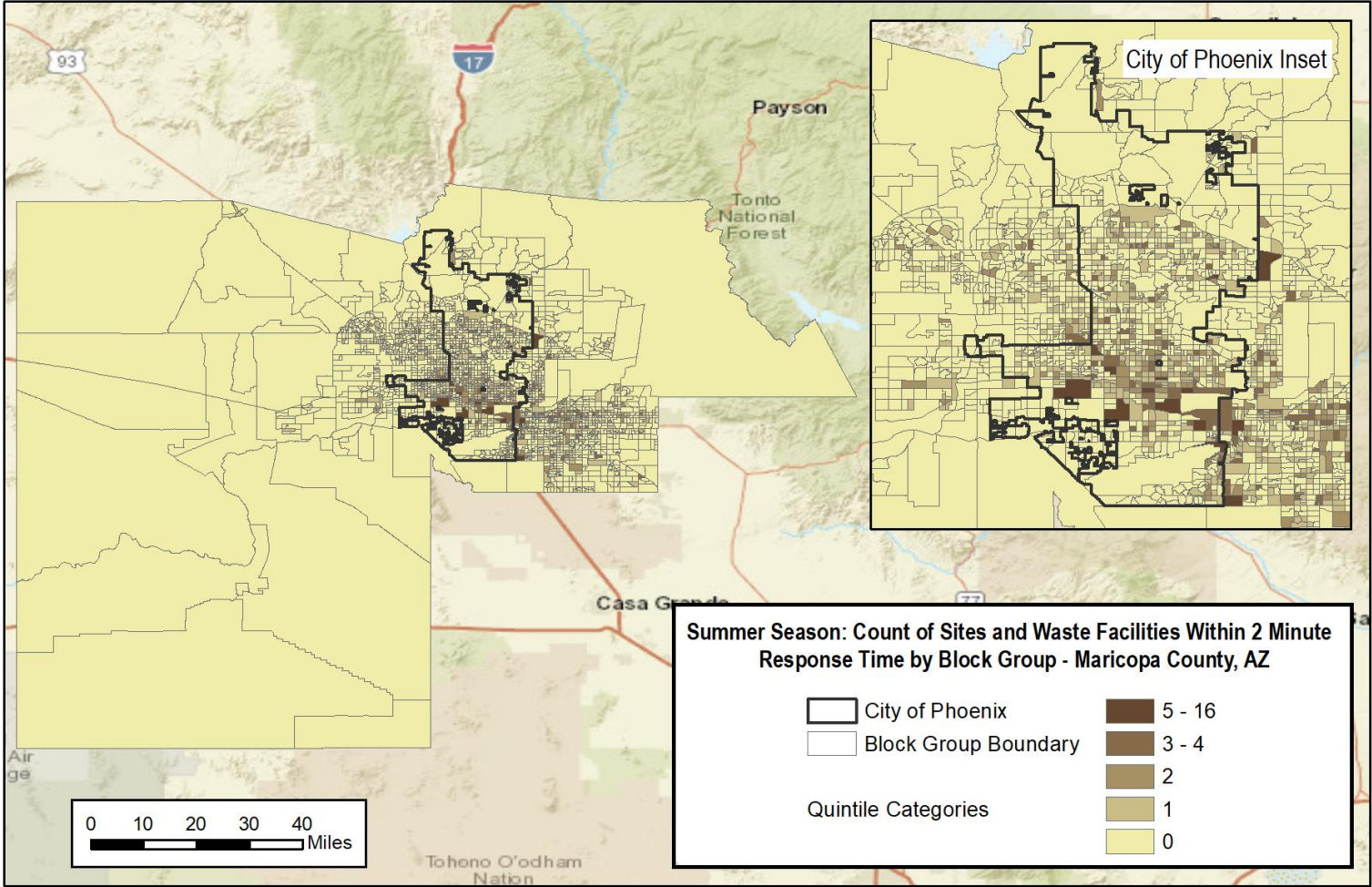
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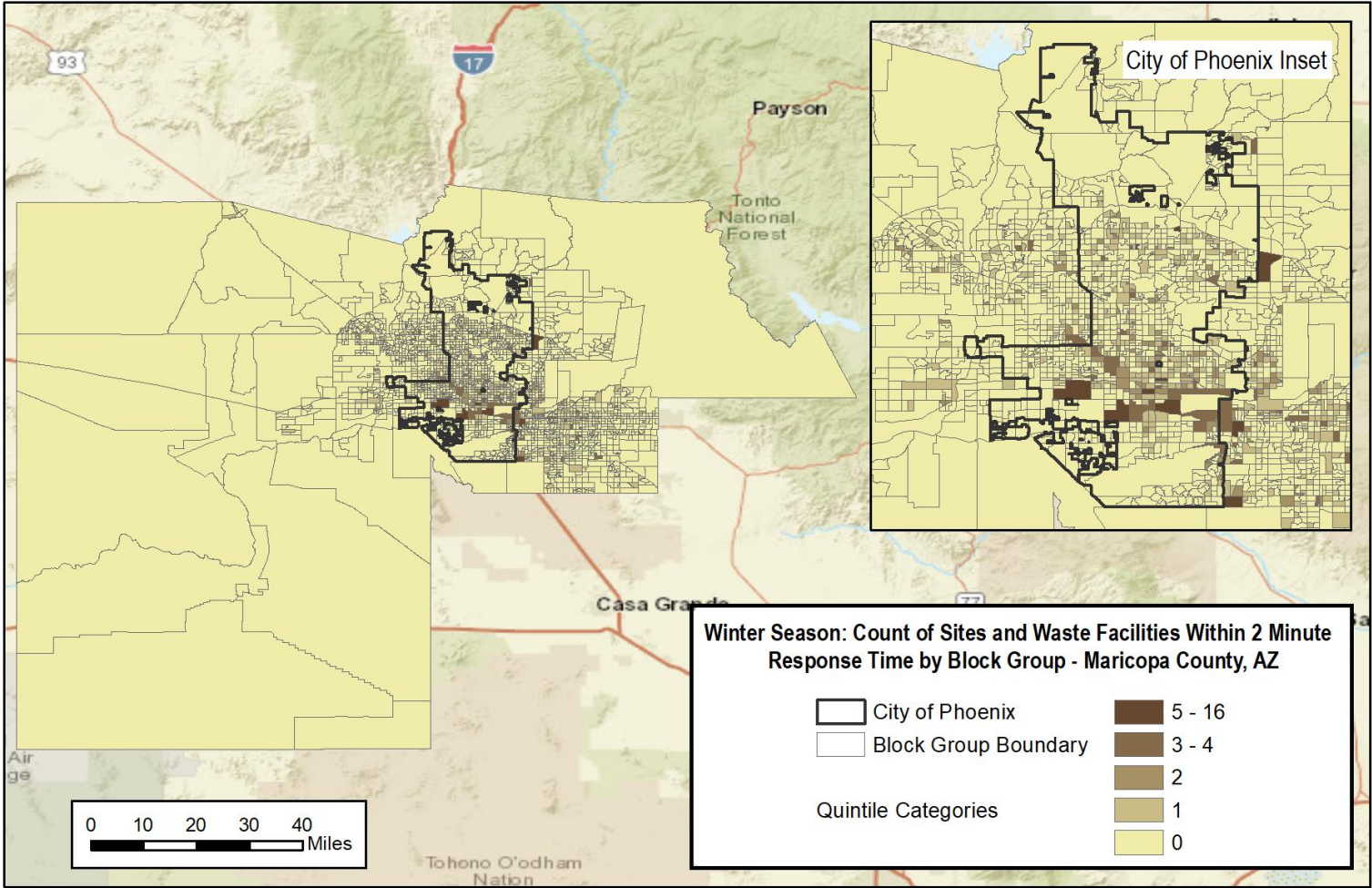


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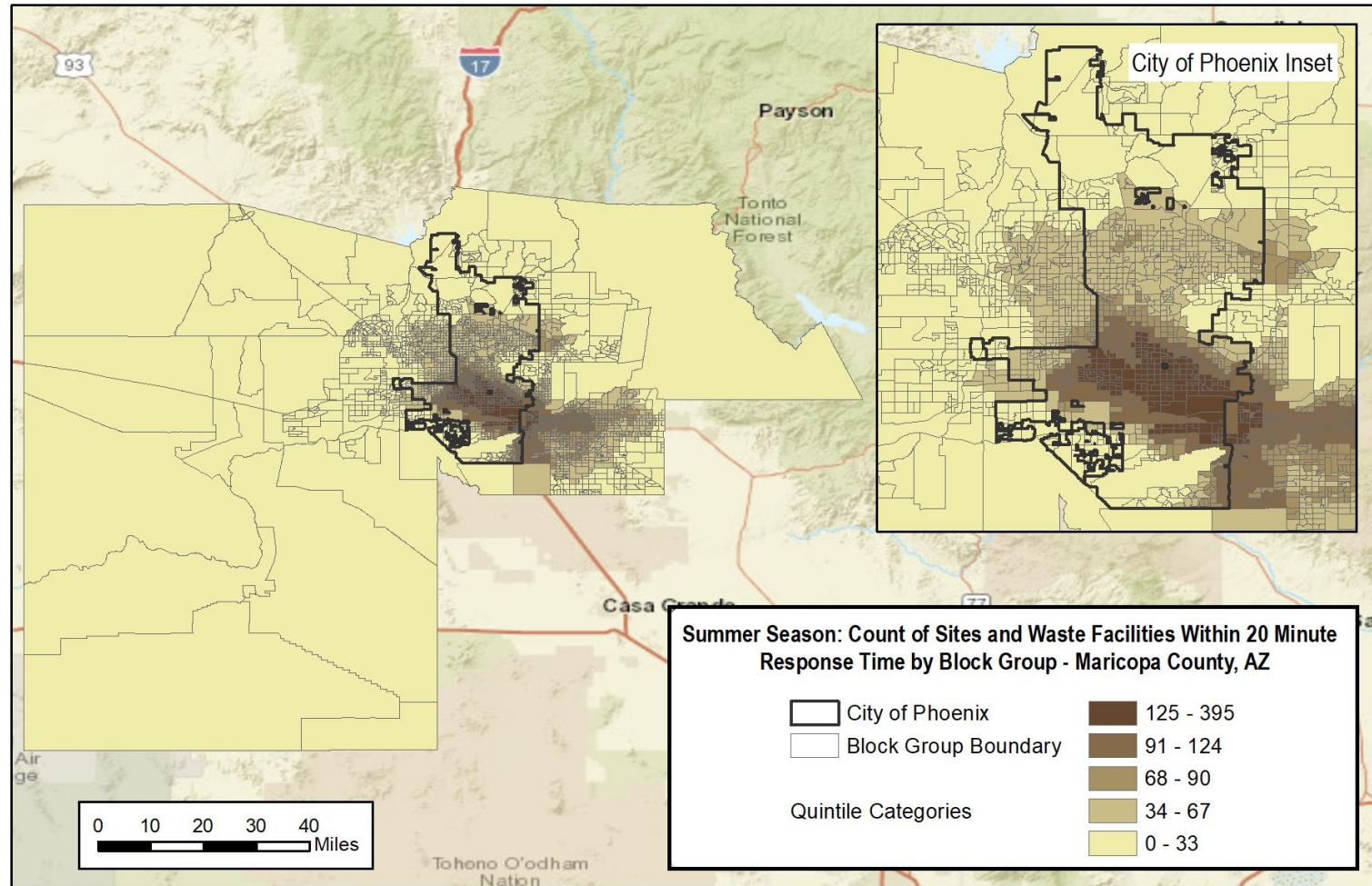
Count of Sites/Facilities That Are Within Specific Response Time Ranges by Block Group: Summer Season



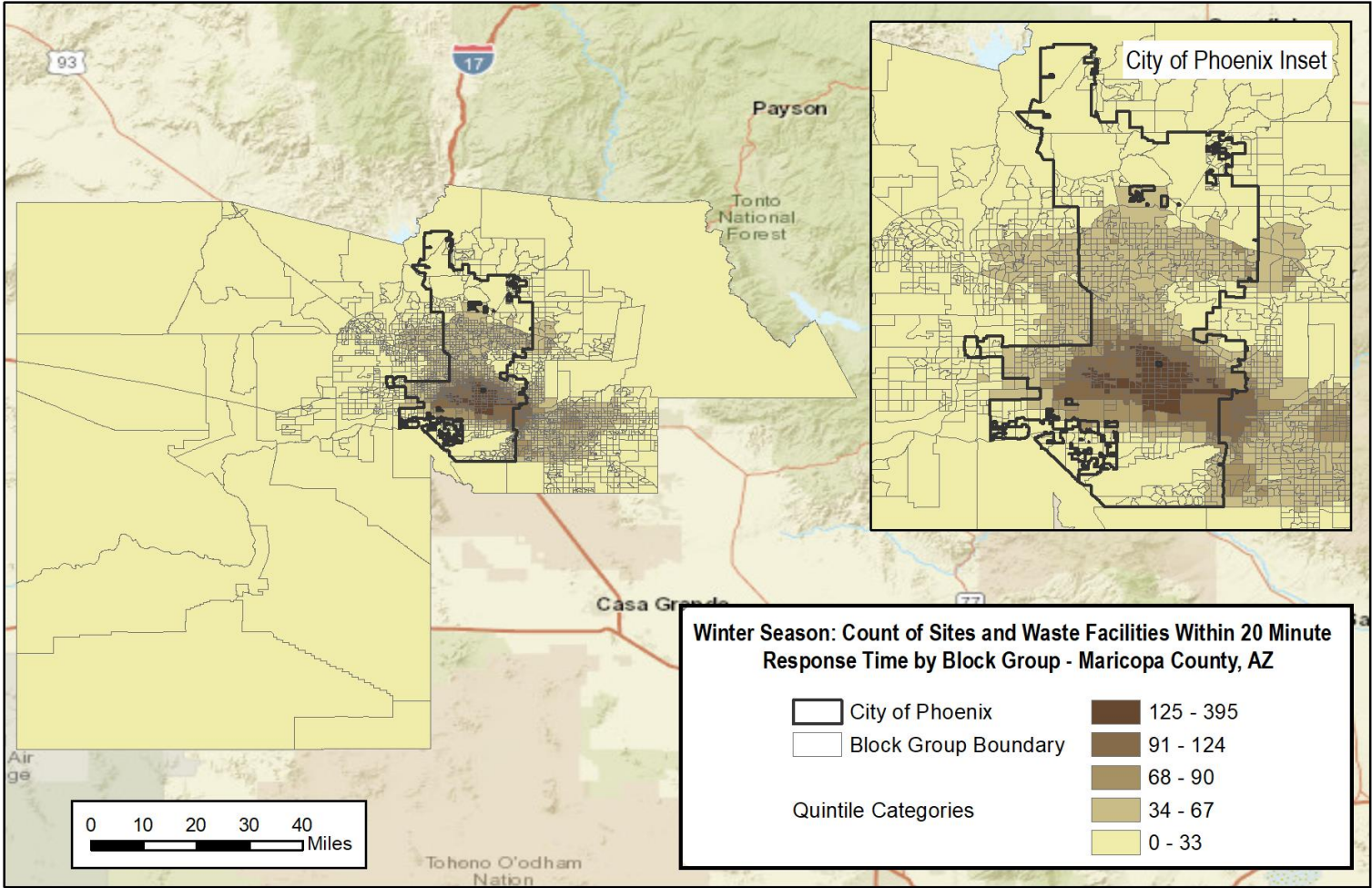
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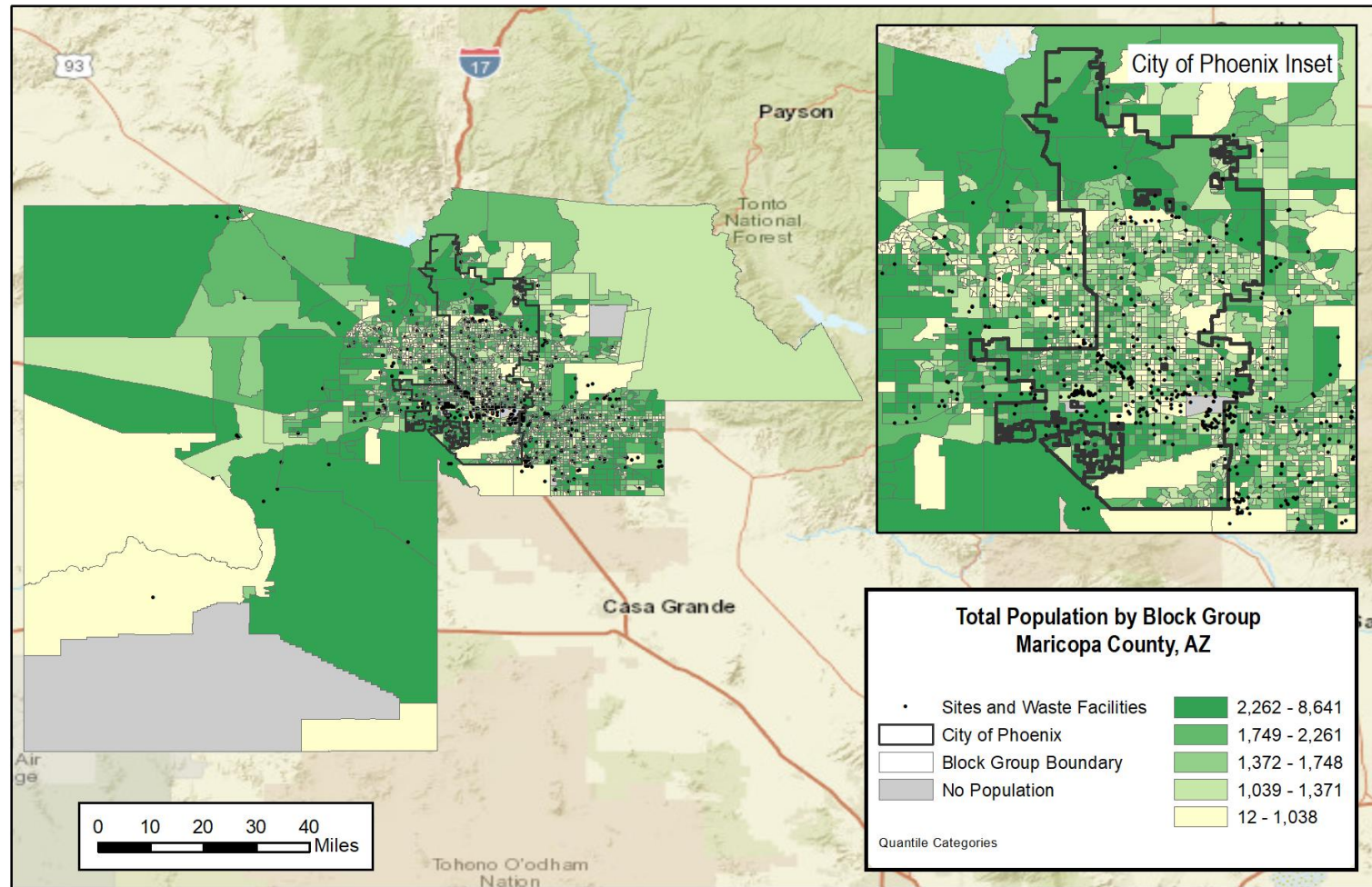
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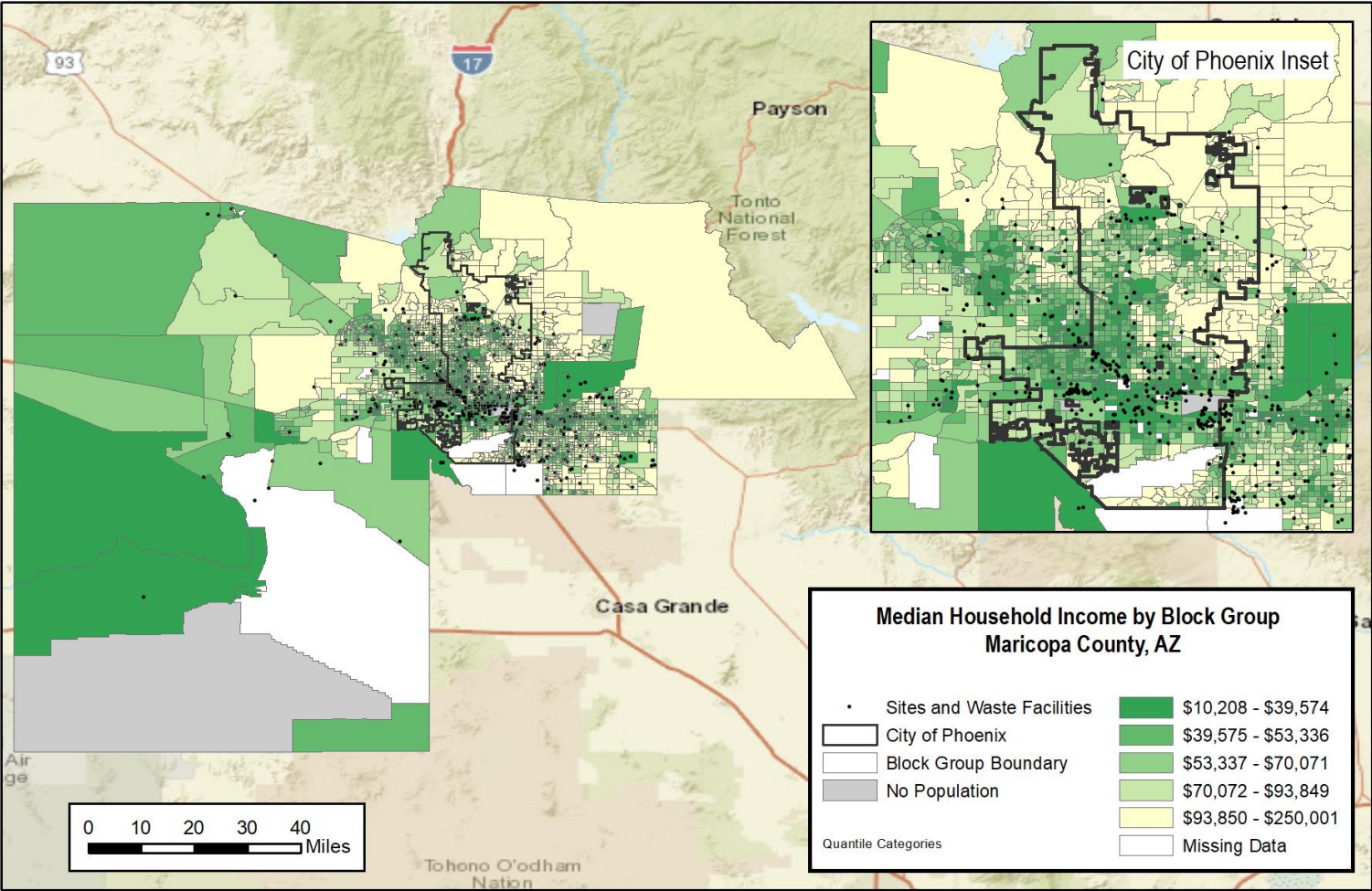
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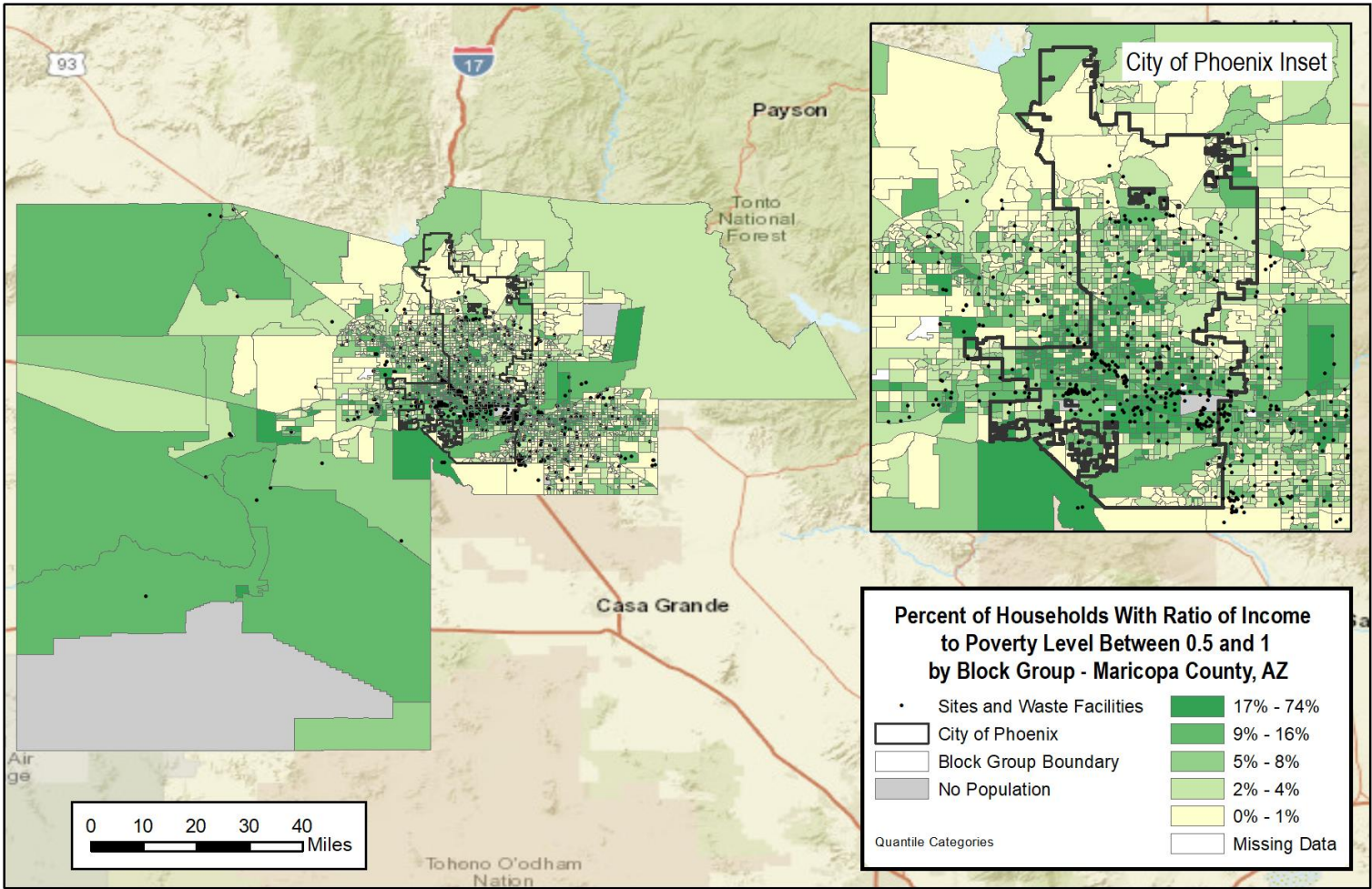
Total Population



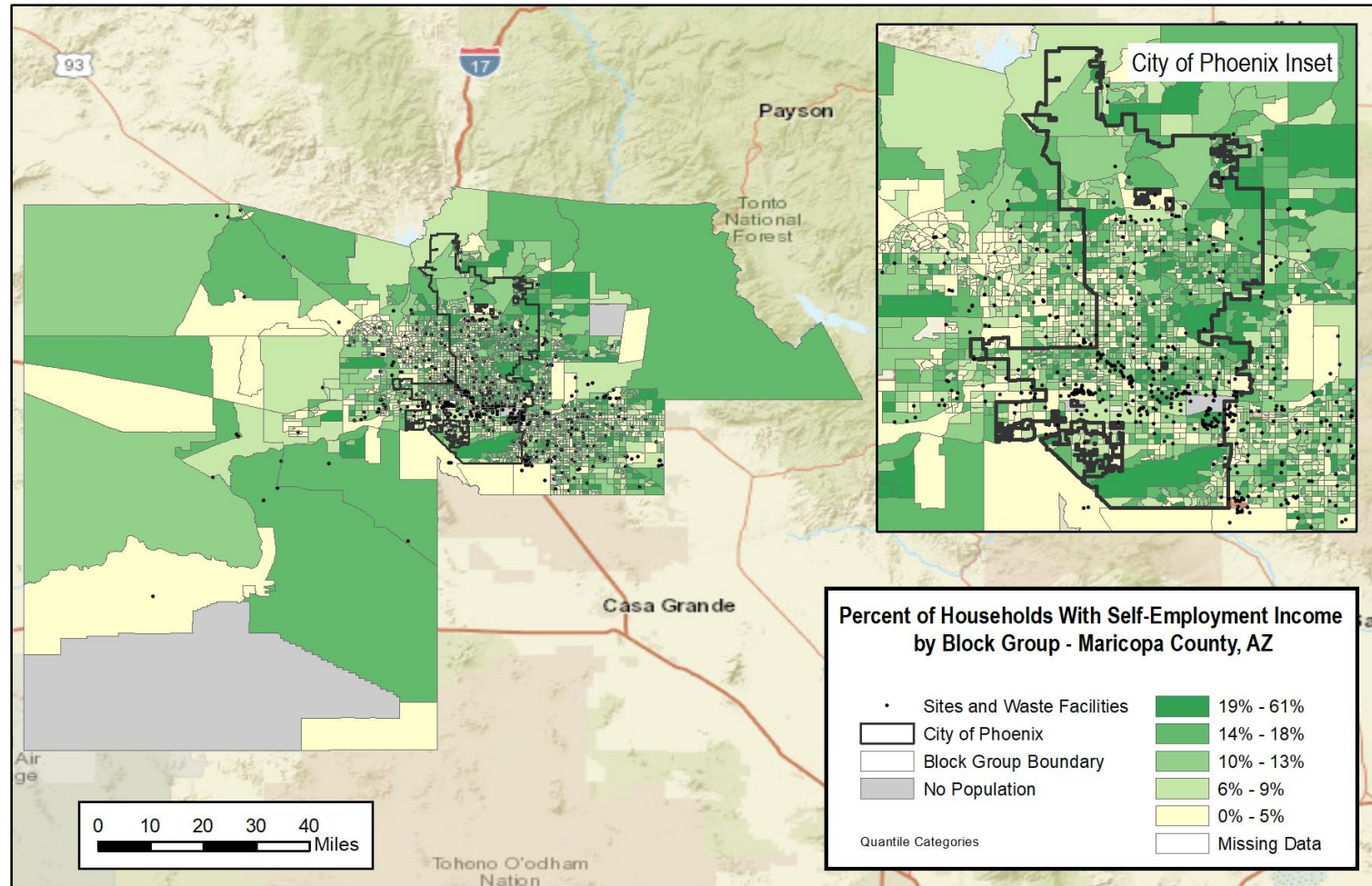
Median Household Income



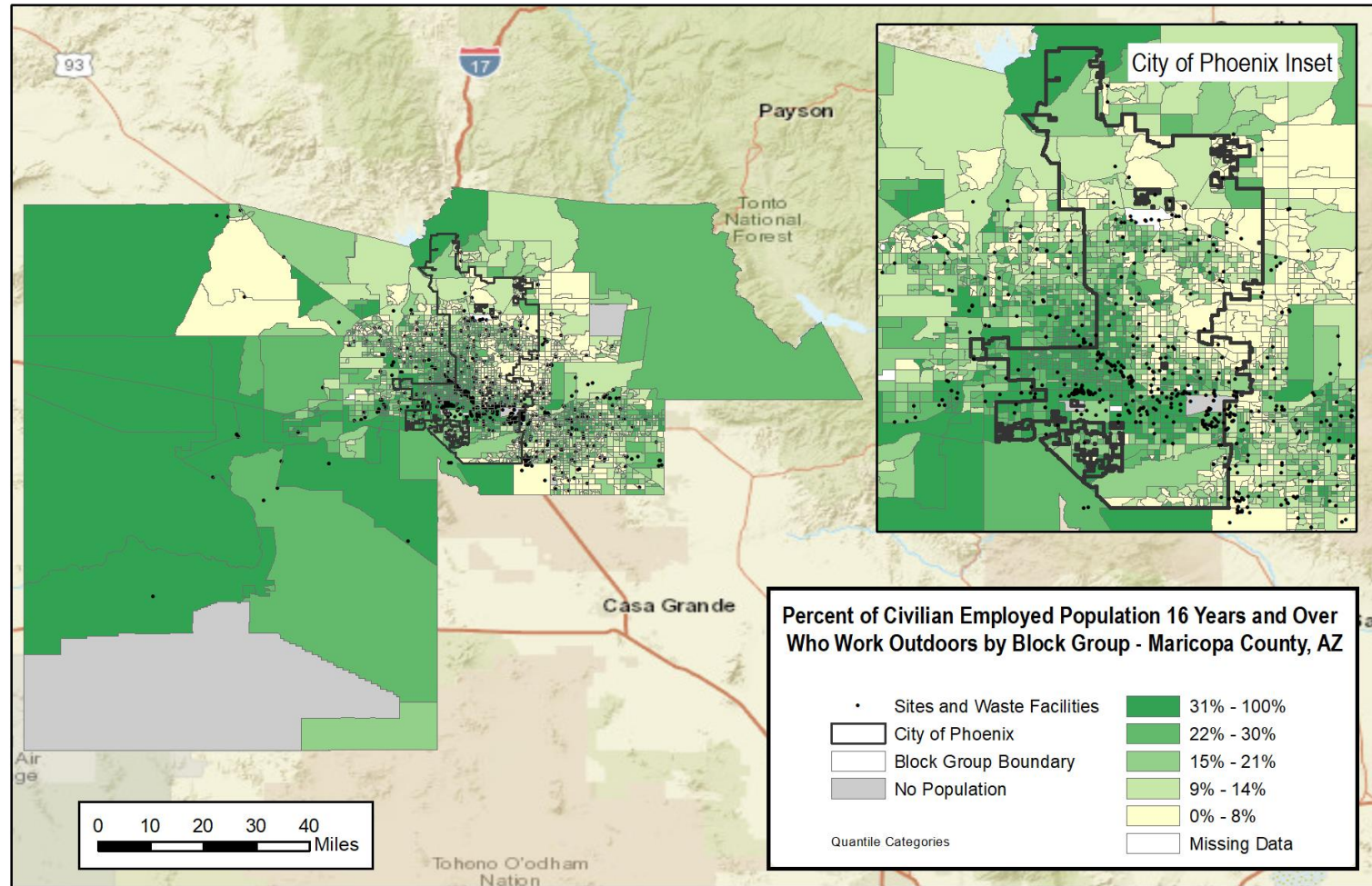
Percent of Households With Ratio of Income to Poverty Level Less than 0.5



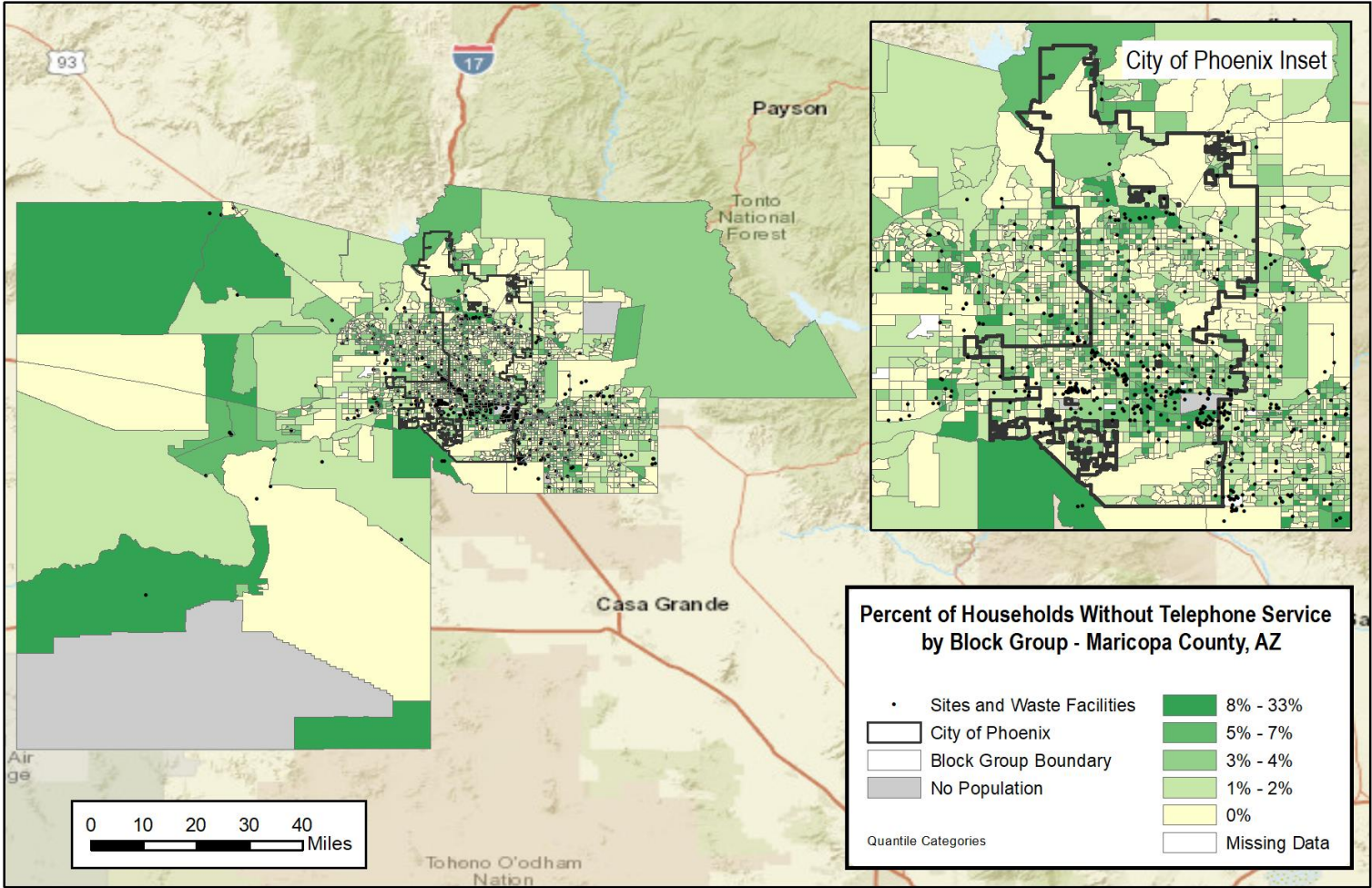
Percent of Households With Self-Employment Income



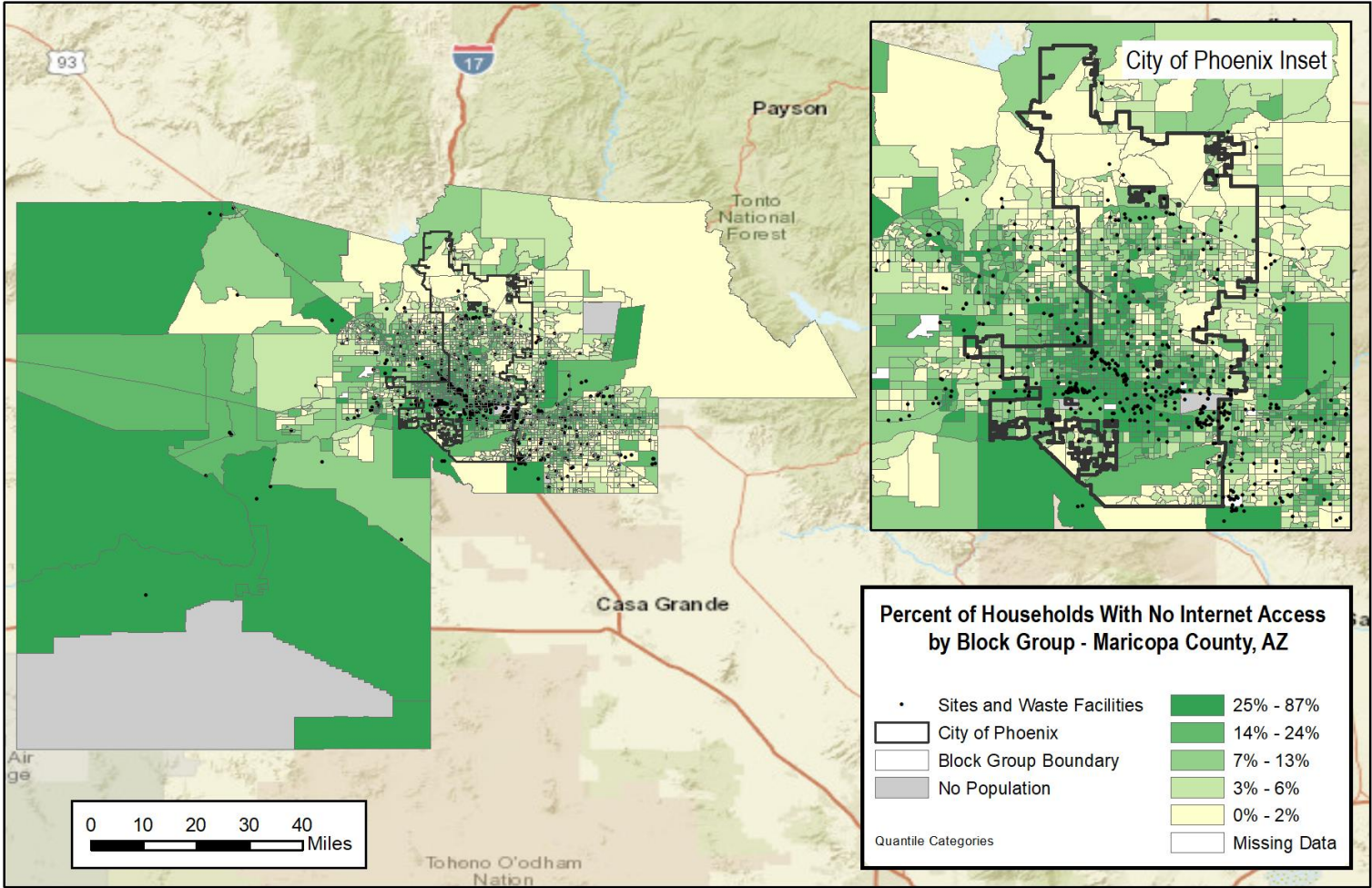
Percent of Civilian Employed Population 16 Years and Over Who Work Outdoors



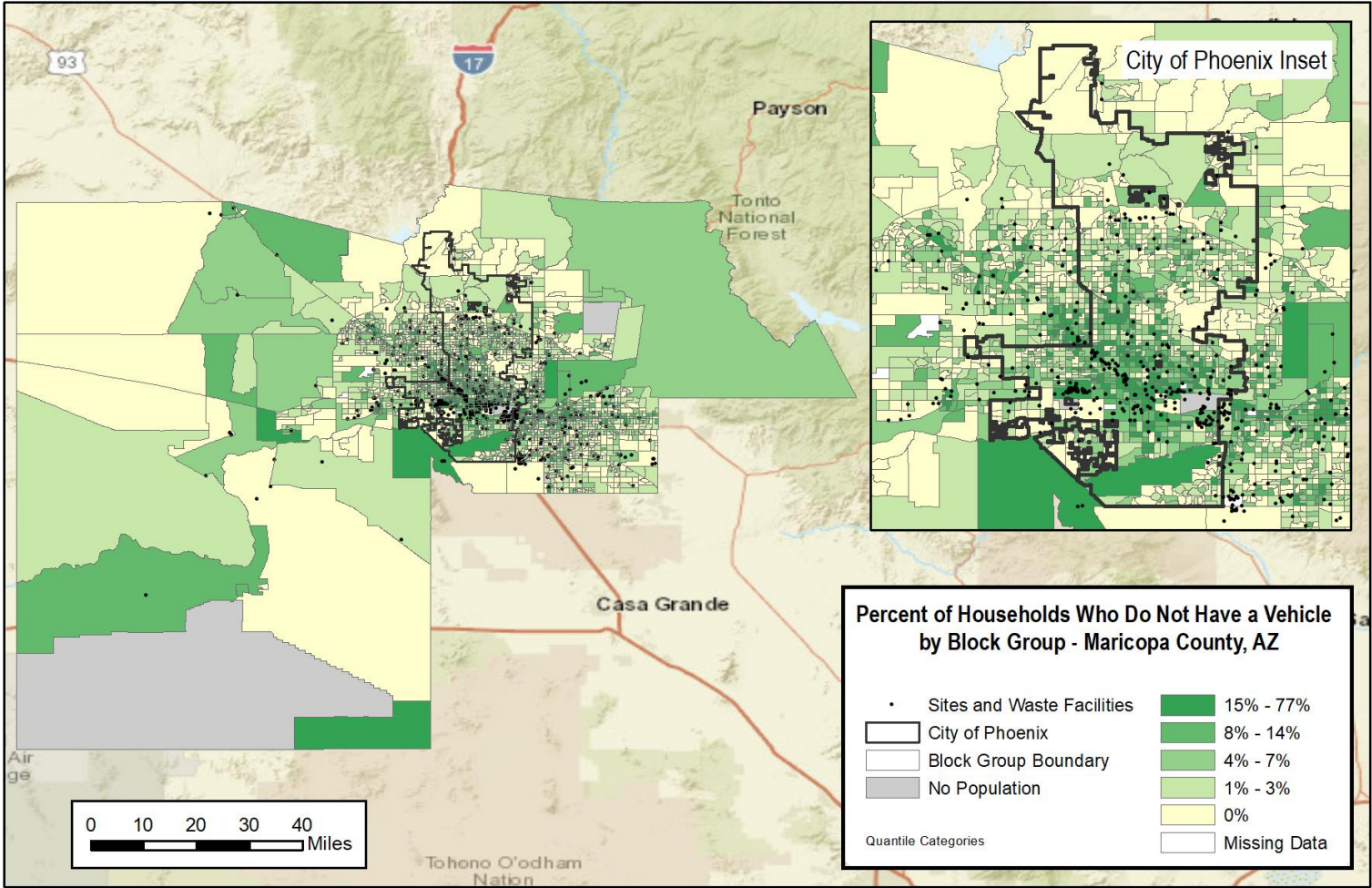
Percent of Households Without Telephone Service



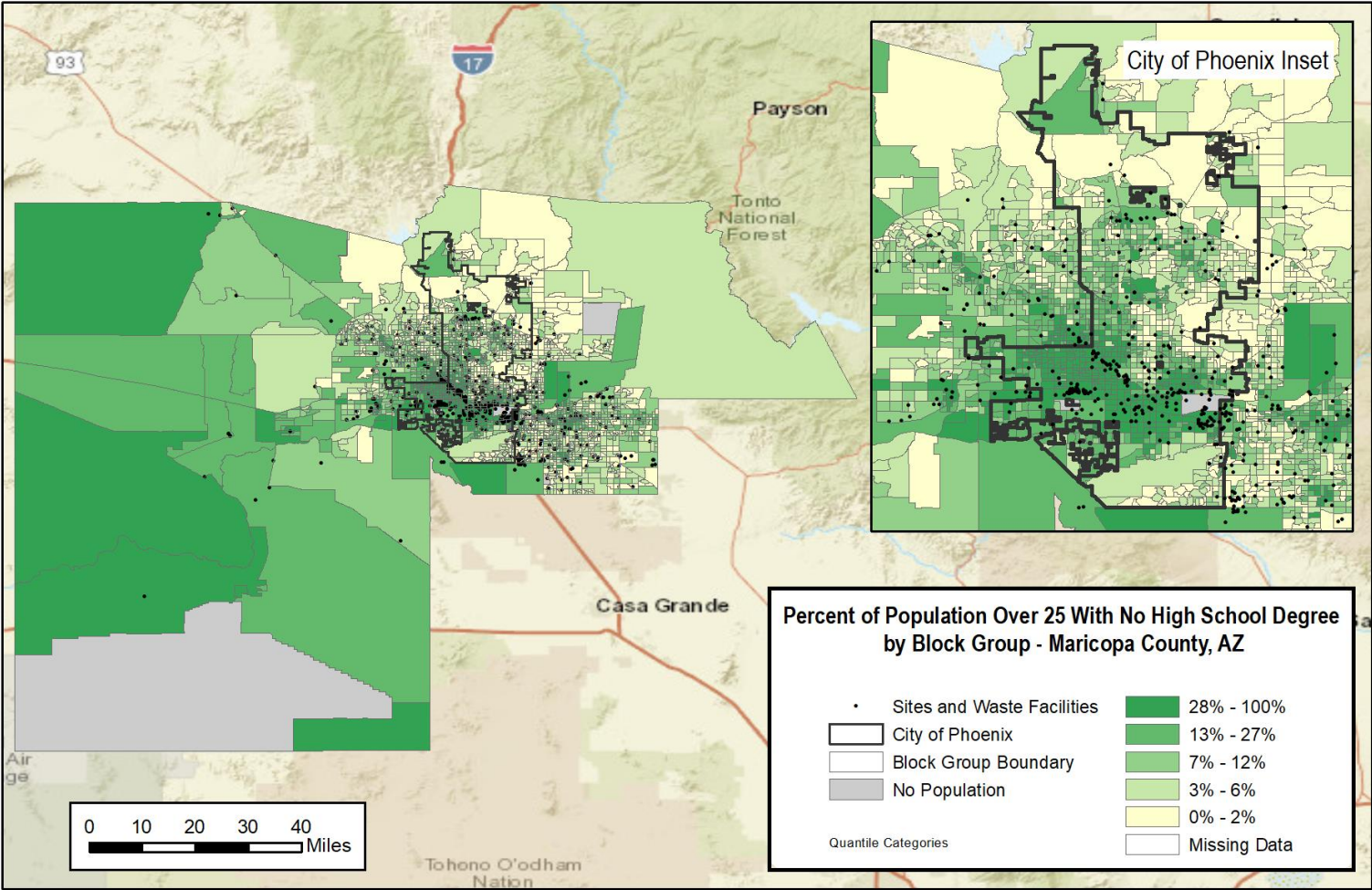
Percent of Households With No Internet Access



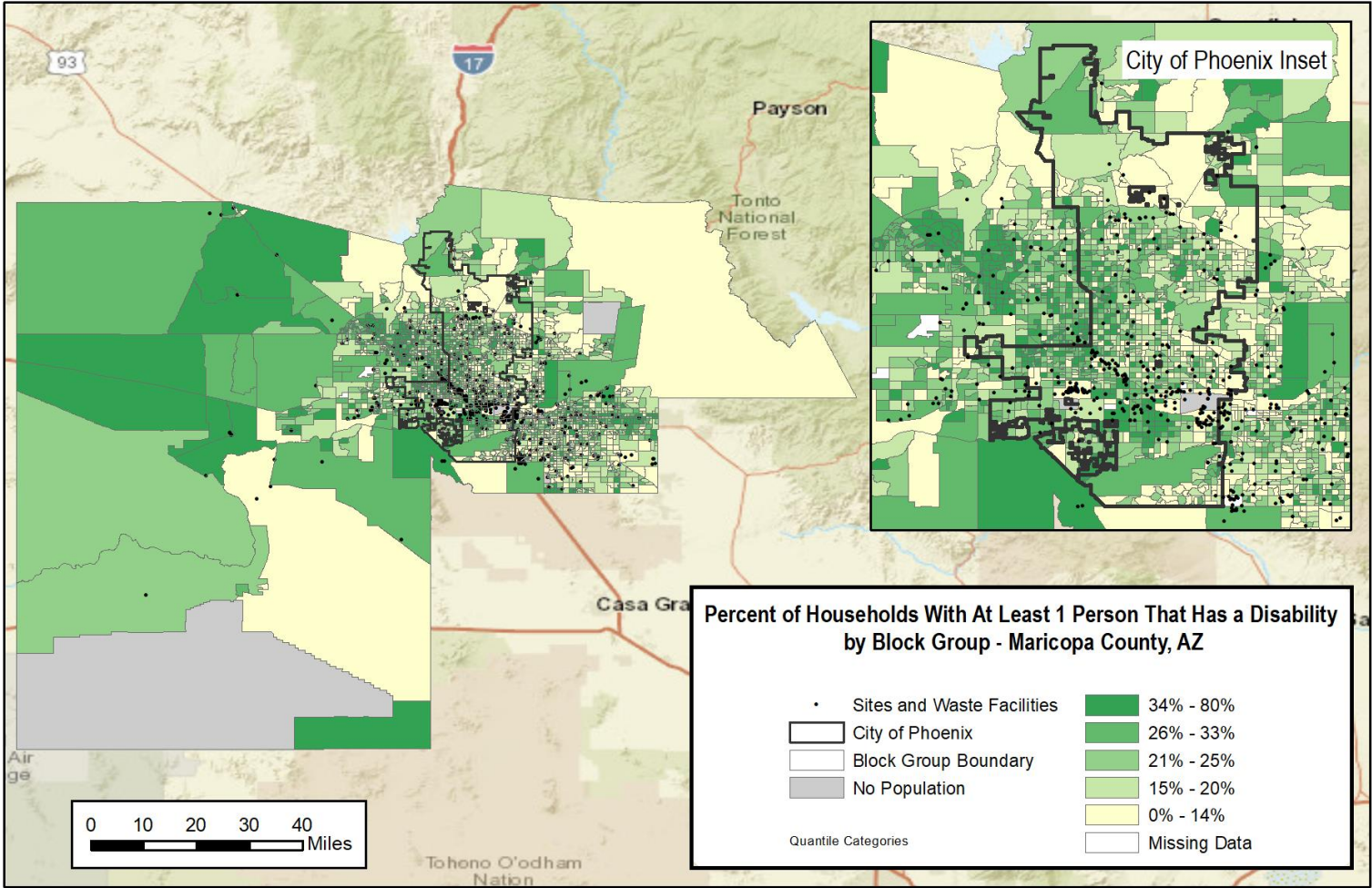
Percent of Households Who Do Not Have a Vehicle



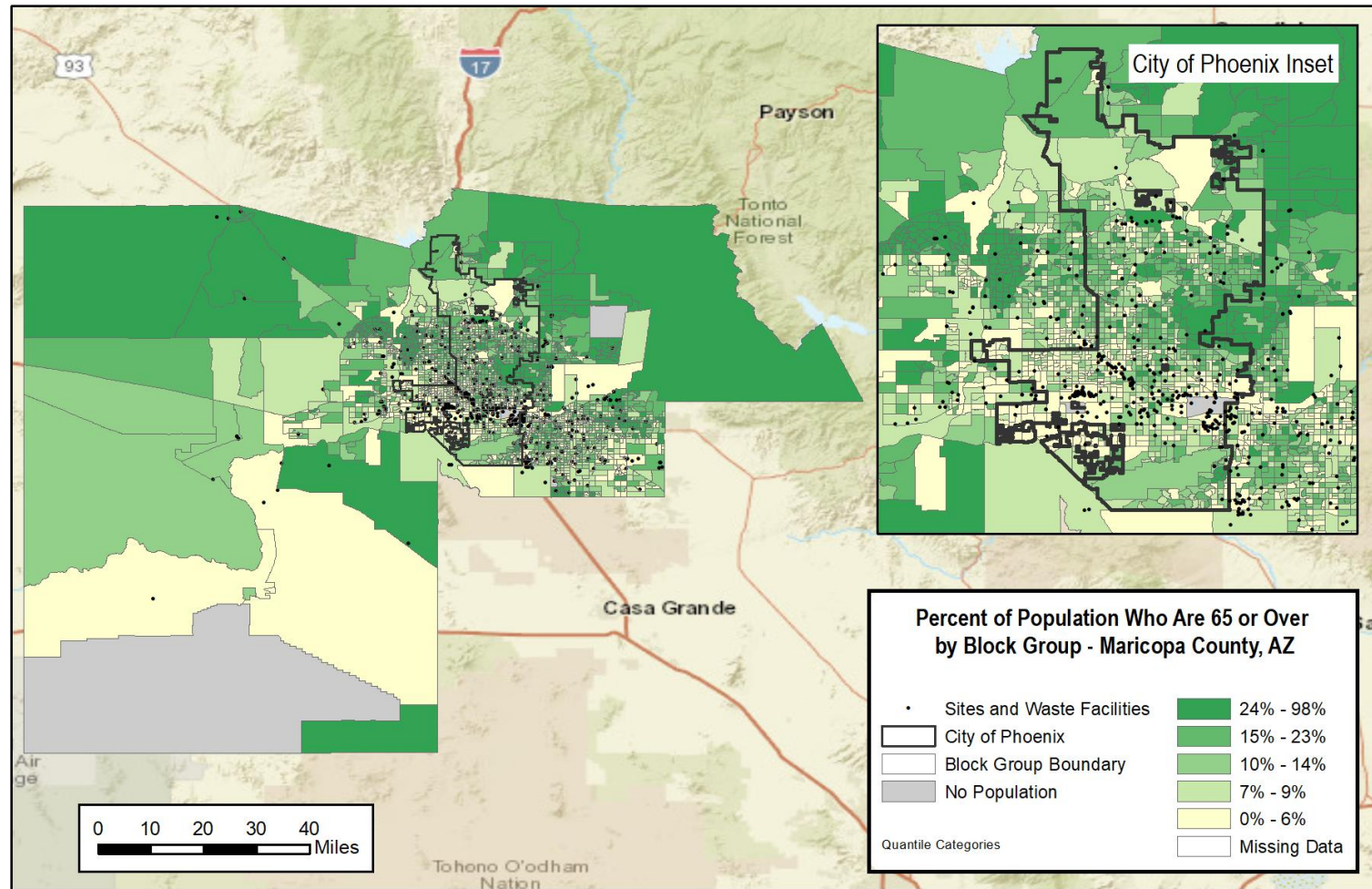
Percent of Population Over 25 With No High School Degree



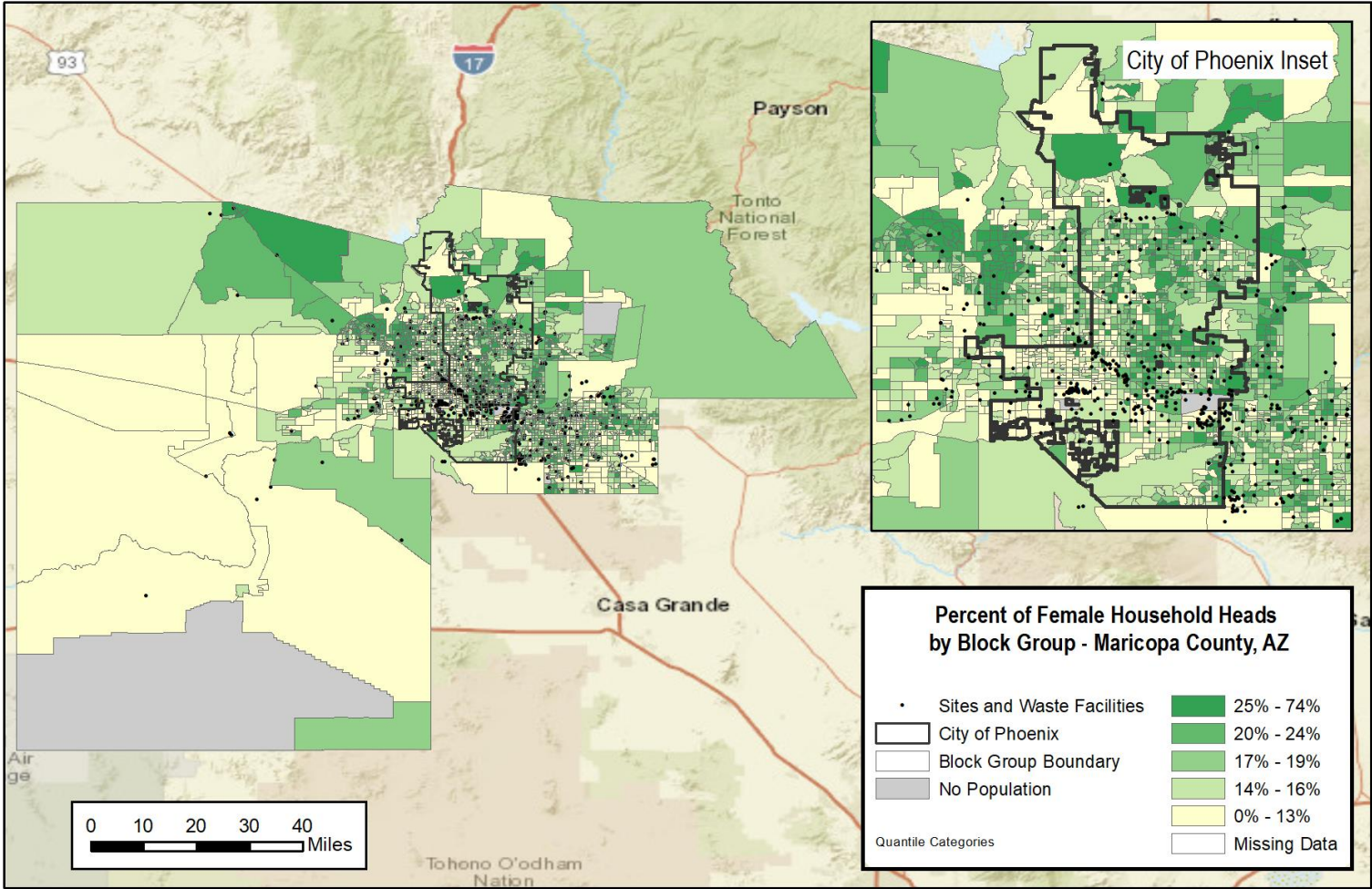
Percent of Households With at Least 1 Person That Has a Disability



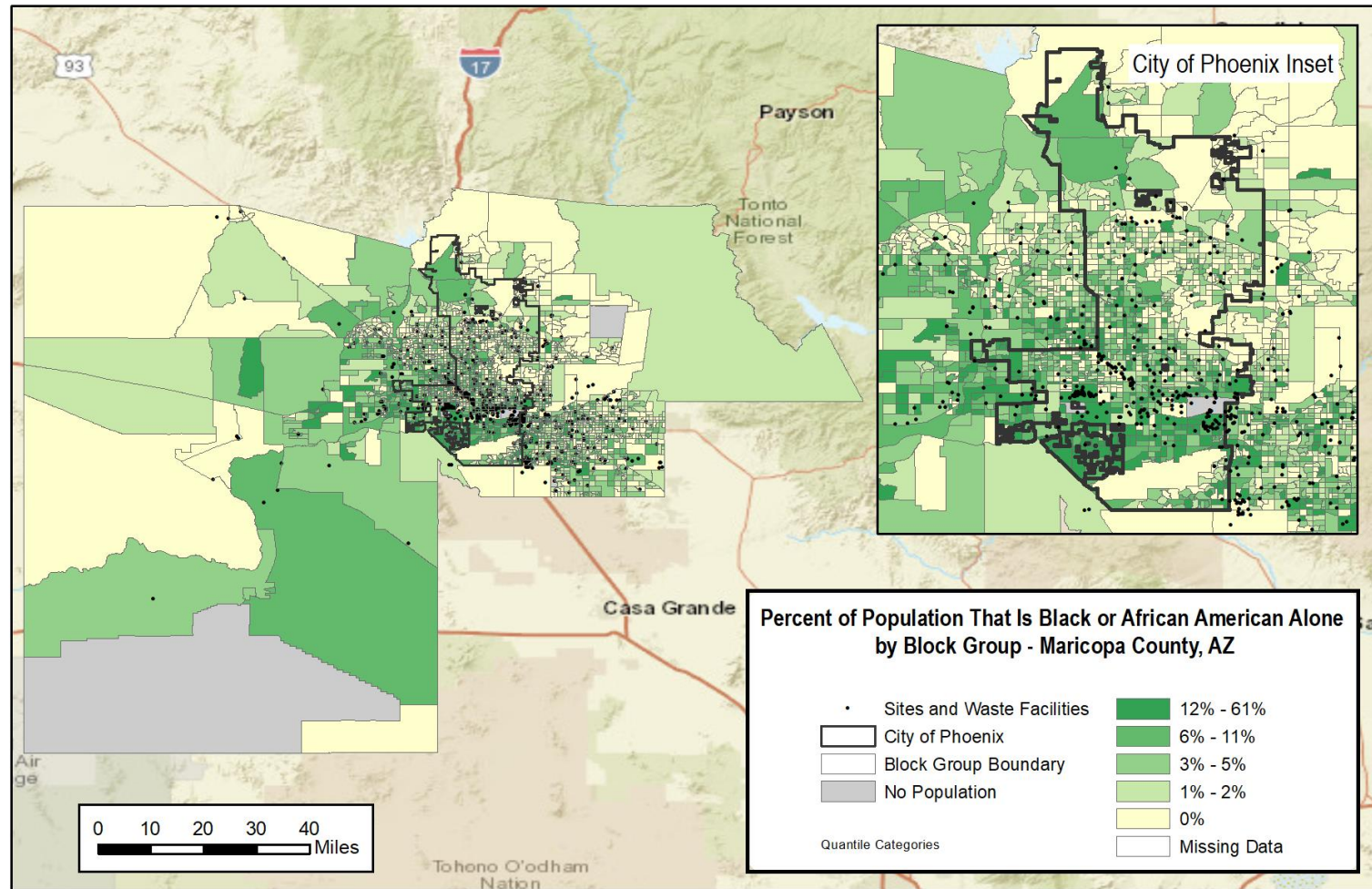
Percent of Population Who Are 65 or Over



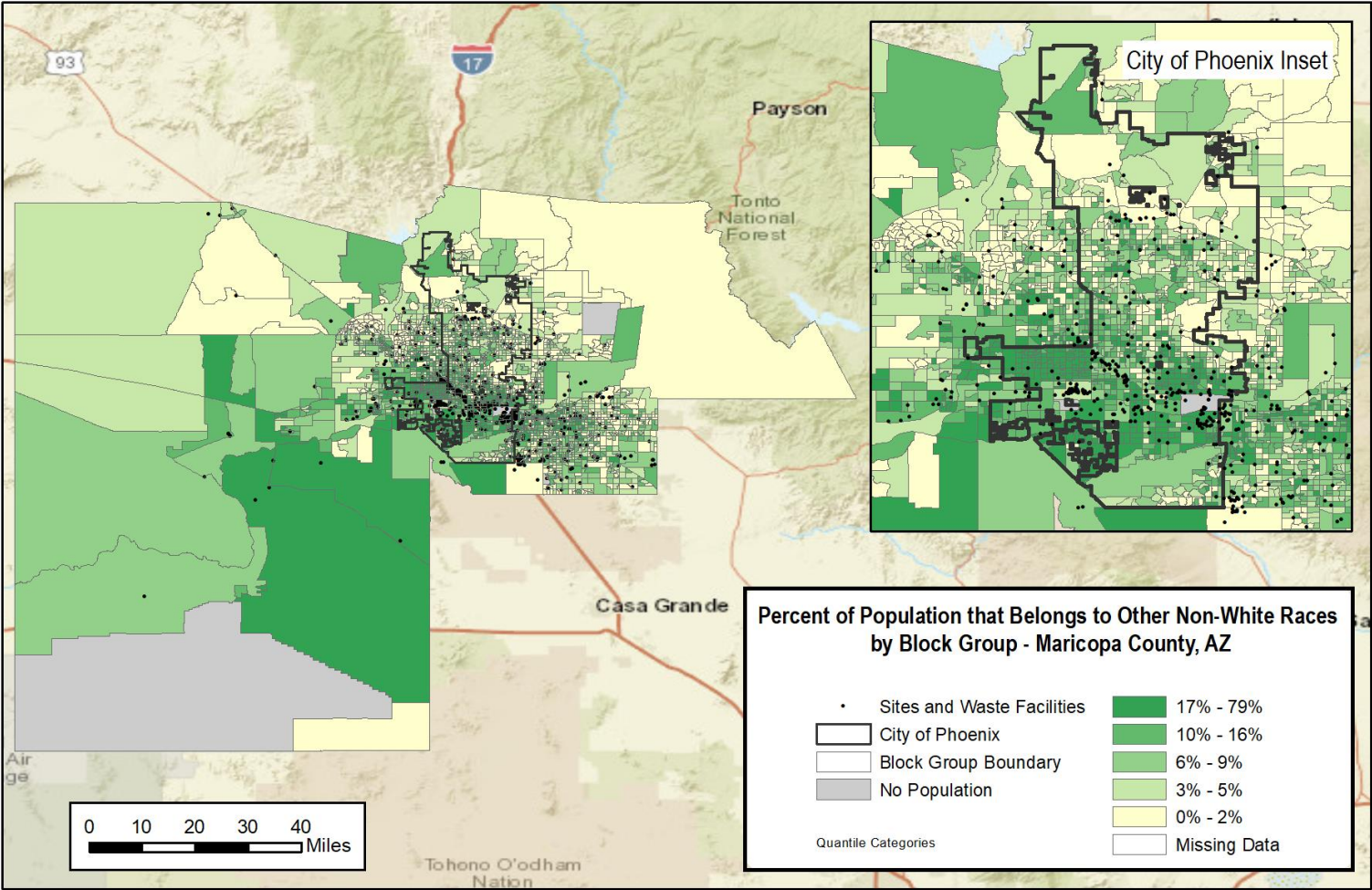
Percent of Female Household Heads



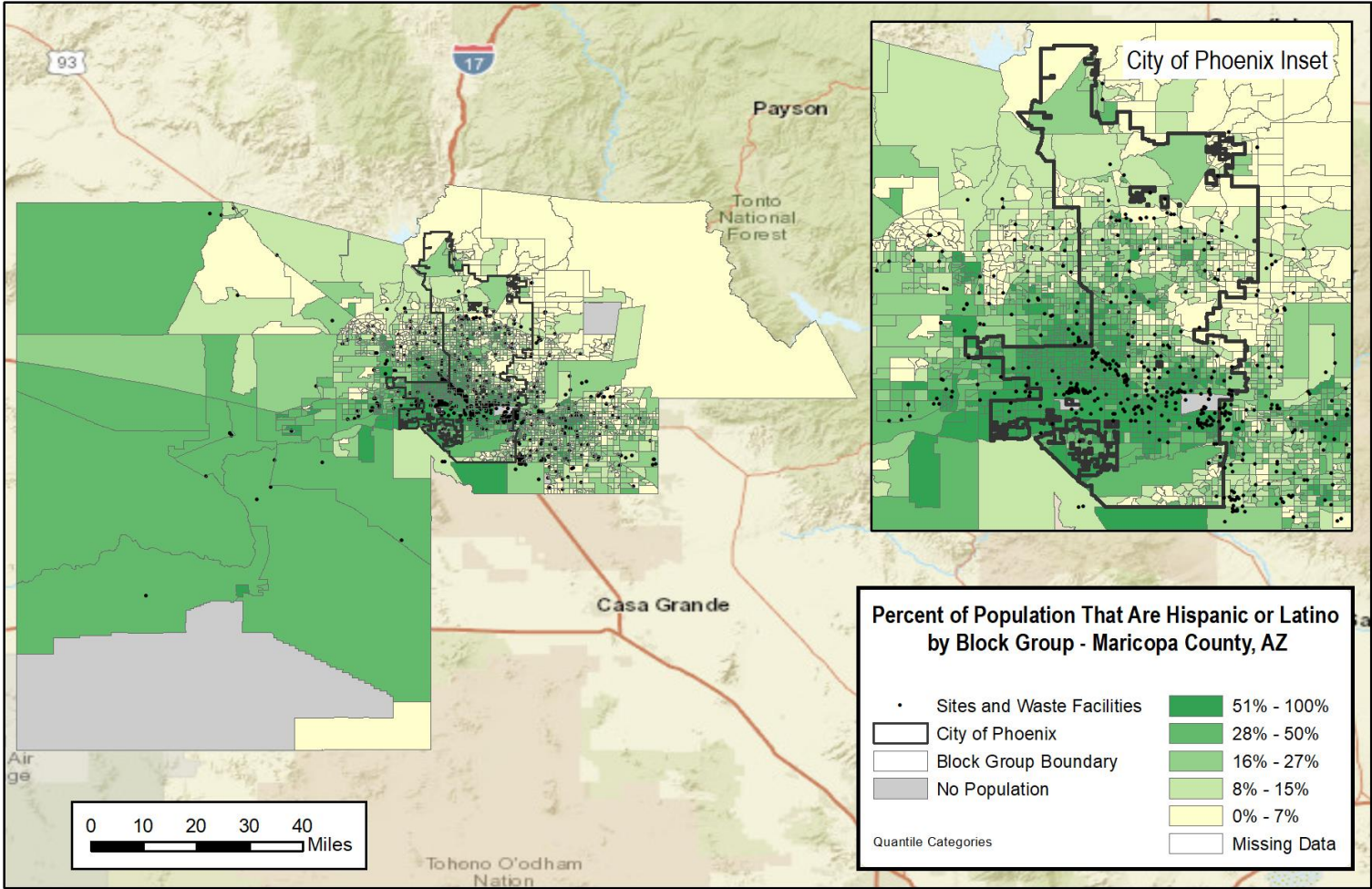
Percent of Population That Is Black or African American Alone



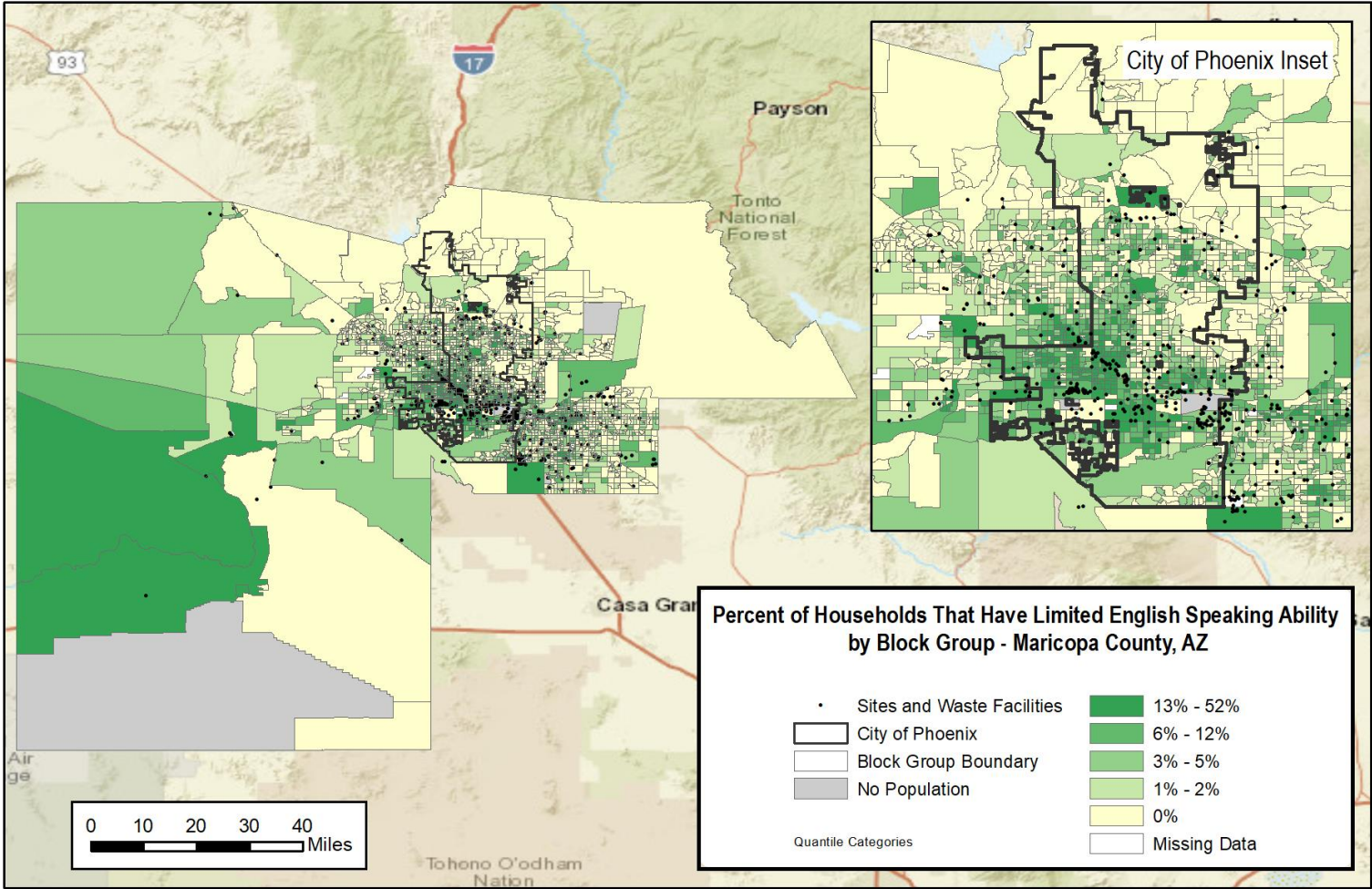
Percent of Population That Belongs to Other Non-White Races



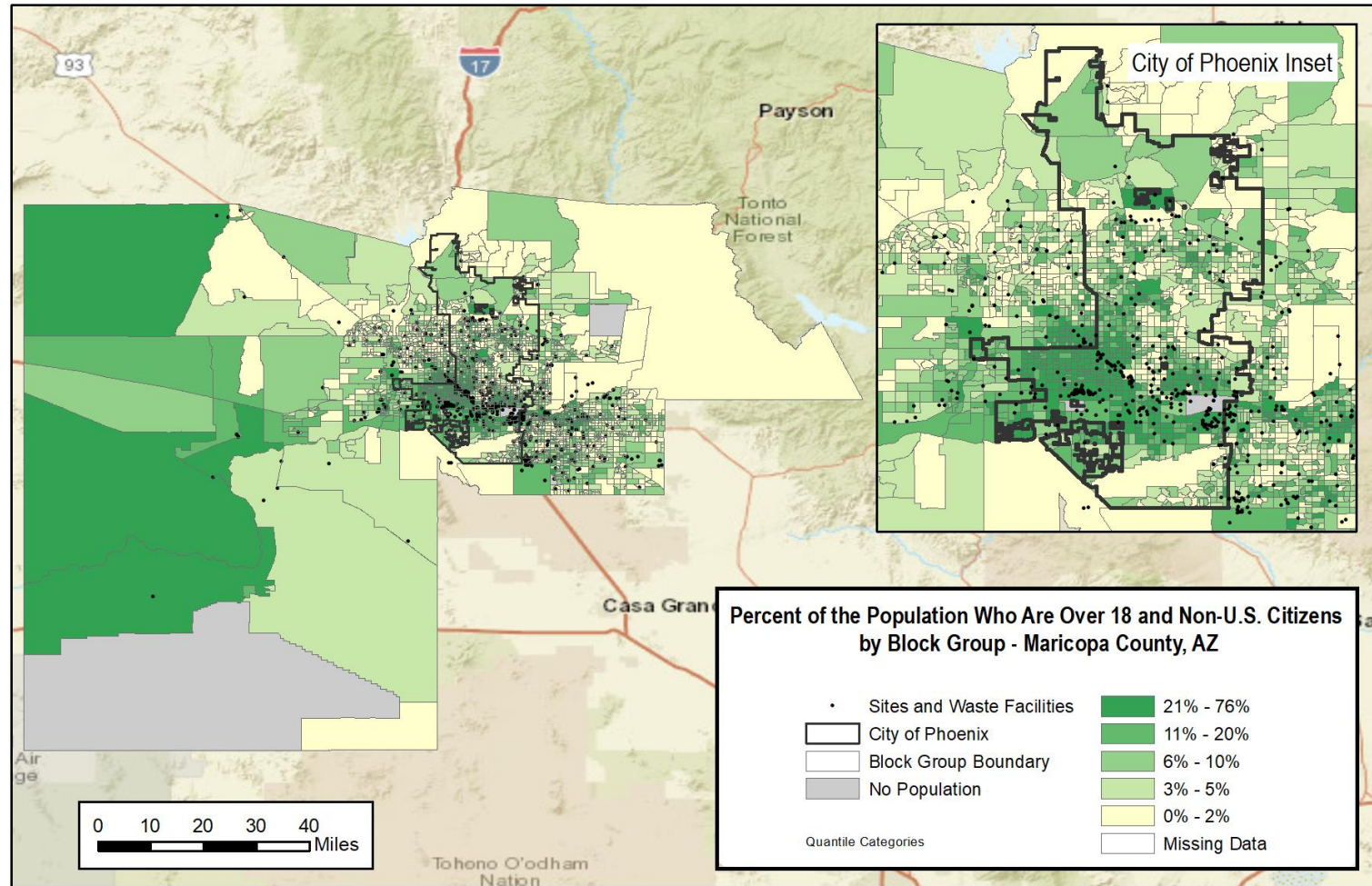
Percent of Population That Are Hispanic or Latino



Percent of Households That Have Limited English-Speaking Ability



Percent of the Population Who Are Over 18 and Non-U.S. Citizens





Thank you!

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