Spatial Analysis of Spokane Crime Statistical Data 2013 to 2015

Steven Beseau

Eastern Washington University

This report is a brief analysis of crime statistical data from Spokane, WA, for the years 2013 through 2015, and includes population data from the 2010 US Census. The study area is defined by the Neighborhoods boundary layer as accessible through Spokane Open Data, which is visible in each of the attached maps used in this analysis. The goal of this report is to answer four main questions which are used to guide this analysis and answer spatial questions concerning the statistical data, including: (1) what spatial patterns can be identified based on the locations of all crimes for the three years of data, (2) how does the Spokane neighborhood with the most total number of crimes compare to the neighborhood with the highest per capita crime rate, (3) how does a specific criminal offense change between the three years of data, and (4) how can maps of crime data be intentionally misused? Included in answers will be discussions of methodology. Supporting maps are attached at the end of this report.

(1) What spatial patterns can be identified based on the locations of all crimes for the three years of data?

In *Identifying Crime Hotspots* (Chainey and Ratcliffe, 2005), the argument is made that a singular ideal technique does not exist. Instead, multiple methods are recommended since each have different strengths that may complement each other. Adhering to this advice, question one is answered using two separate methods of density analysis to search for visual spatial patterns.

The first method utilized is a heat map. Each of the three years of crime data were first clipped within the Neighborhoods layer to eliminate extraneous points outside of the target area, and then were saved in a geodatabase for future use. Next, the heat map symbology was applied to each of the three crime data layers, and adjustments were made to the radius and color scheme until a visual pattern emerged. The result can be seen in the three attached maps: *Spokane Crime Data 2013 Heat Map Analysis, Spokane Crime Data 2014 Heat Map Analysis*, and *Spokane Crime Data 2015 Heat Map Analysis*. Identical values were used to define the hot spot symbology in each of the three maps. The greatest concentration of crime seems to appear in the Riverside neighborhood across all three years. There also seems to be an overall increase in crime rates each year, as is evidenced by the slowly increasing amount of purple and red in the later maps, and culminating in the appearance of a highly noticeable yellow area in the Shiloh Hills neighborhood in 2015.

Method two uses optimized hot spot analysis. Duplicates of the previously created crime point features were run through the optimized hot spot analysis tool bound by the Neighborhoods study area, and resulted in a fishnet grid as can be seen in the attached maps: *Spokane Crime Data 2013 Optimized Hot Spot Analysis*, *Spokane Crime Data 2014 Optimized Hot Spot Analysis*, and *Spokane Crime Data 2015 Optimized Hot Spot Analysis*. The advantage of the optimized hot spot analysis over the heat map is that statistical degrees of confidence are included in the map results. The shortcoming is that the optimized hot spot analysis does not zero in on a specific area of interest, such as the Riverside neighborhood that appeared in the heat maps from method one. Instead, method two reveals a high number of crimes occurring in the central and northern neighborhoods along Division Street. While there are many factors that go into policing, being able to identify specific problem areas when resources are limited may be more important than statistical accuracy in the short term. However, both methods fail to consider other factors, such as population, zoning, and types of crimes.

(2) How does the Spokane neighborhood with the most total number of crimes compare to the neighborhood with the highest per capita crime rate?

This question is answered with two maps: *Spokane 2015 Total Crime by Neighborhood*, and *Spokane 2015 Crime as Percent of Neighborhood Population*. The first map uses the 2015 crime data layer that was spatially joined to the Neighborhoods layer. The spatial join automatically generated a field name called "Join_Count"; the numerical value in this field is the total number of all crimes committed in each of the 29 neighborhoods. The value for each neighborhood is displayed visually using a graduated scale adjusted so only the highest value contains the darkest color from the chosen color scheme. In 2015, the highest number of crimes occurred in the Shiloh Hills neighborhood. This highlights one of the failings of the heat map above, as the heat map shows the crime hot spot being in the Riverside neighborhood, but the heat map has more to do with the tight proximity of the surrounding data points than the total number of crimes in a single neighborhood.

The second map was created by spatially joining the Neighborhood layer to the clipped USA_tracts layer, and then joining the result with the 2015 crime data. The final layer contains both population data from the 2010 US Census and total crimes in each neighborhood. The symbology was again changed to a graduated scale and percentages adjusted so only the top number of crimes as normalized by the 2010 population appeared; the top percentage is in the Riverside neighborhood. This difference in location between Riverside and Shiloh Hills can be explained by the fact that Shiloh Hills is a business area with lower population levels as compared to the Riverside neighborhood, which has high density residential areas. Also, as a business area, property crimes are far more likely to be reported in the Shiloh hills neighborhood due to corporate policies and insurance concerns.

(3) How does a specific criminal offense change between the three years of data?

Question three is answered with three maps: *Spokane 2013 Total Thefts by Neighborhood*, *Spokane 2014 Total Thefts by Neighborhood*, and *Spokane 2015 Total Thefts by Neighborhood*. Thefts were selected by attribute from each of the three crime layers. Each selection was then individually joined to the Neighborhood layer. The resulting joins were then symbolized with graduated symbols. Care was taken to choose a manually defined range that is identical across all three years of data to facilitate comparison. There is an initial reduction in thefts between 2013 and 2014 in the Nevada Heights and Cliff-Cannon neighborhoods. This was followed by increases in thefts from 2014 to 2015 in the Audubon/Downriver, Emerson/Garfield, and Southgate neighborhoods. It is hard to tell what the cause of these changes might be without more data. Speculatively, increased patrols around Shiloh Hills—which is a high business area—may have led to reductions of thefts in Nevada Heights due to being immediately adjacent to Shiloh Hills. Over time, these reductions may have led to the spreading out of thefts into other areas of the city as police patrols were redirected.

(4) How can maps of crime data be intentionally misused?

People have a tendency to emphasize information that supports their point of view. In the answer to question two above, the *Spokane 2015 Total Crime by Neighborhood* map showed the highest crime rates in the Shiloh Hills neighborhood, whereas the *Spokane 2015 Crime as Percent of Neighborhood Population* map showed the highest crime rate in the Riverside neighborhood. This exercise shows that the same sets of data can lead to different results. Business owners in the Shiloh Hills area might point to the first map and demand resources are used to service them. However, residents who make up a large percentage of the voter base in Riverside might point to the second map and demand resources are deployed to their neighborhoods. This situation results in a conflict between funding and votes. Ultimately, the people in charge of deciding which maps are seen by the public may emphasize one map and hide the other for political reasons.

References

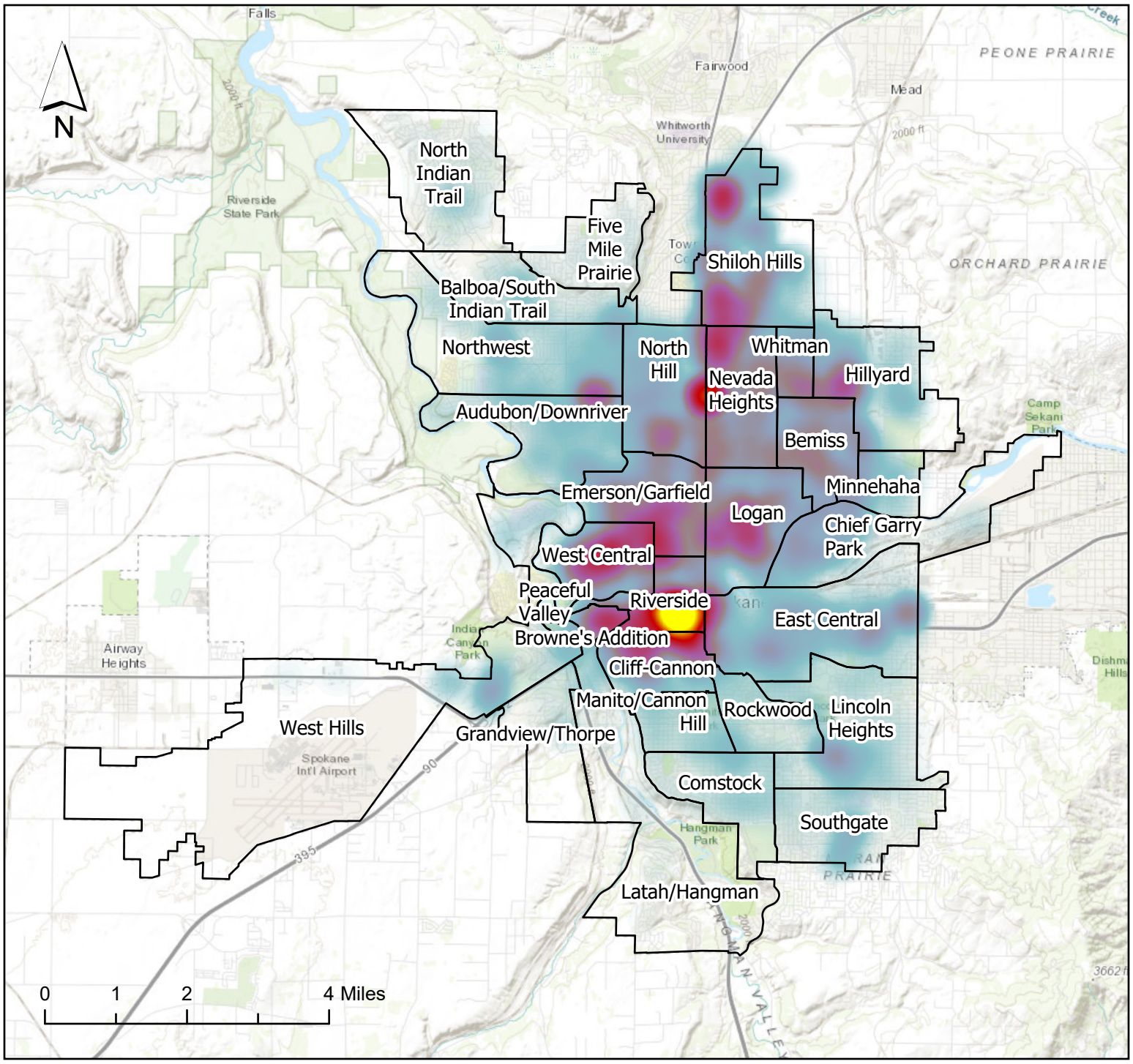
Chainey, Spencer and Ratcliffe, Jerry. 2005. *GIS and crime mapping*. Wiley and Sons.

Open Spokane Data. 2019. Boundary. Crime_2013. Crime_2014. Crime_2015.

http://data-spokane.opendata.arcgis.com/

US Census Data. 2010. USA_tracts. http://www.census.gov

Spokane Crime Data 2013 Heat Map Analysis



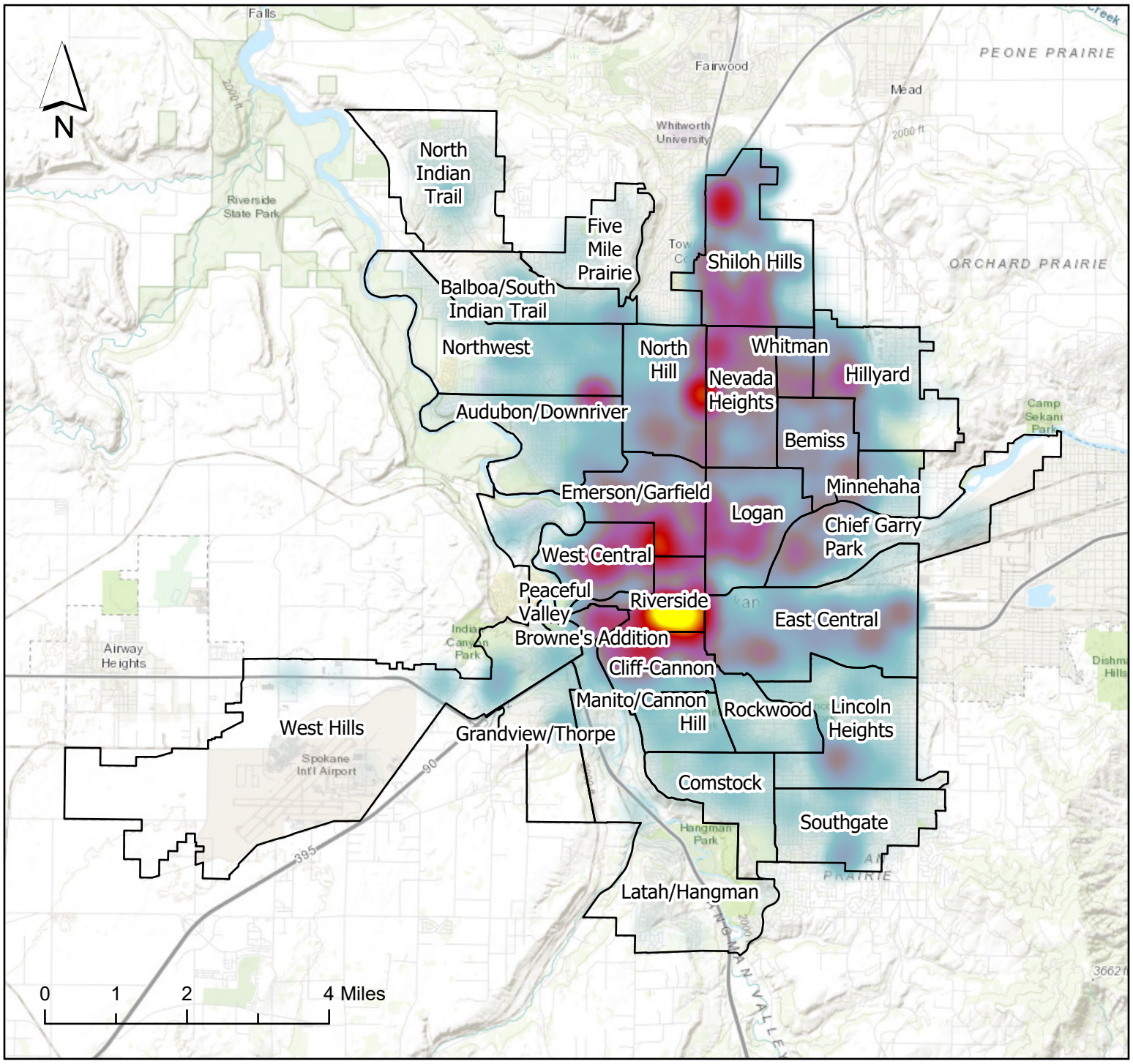
Neighborhood

Sparse

Dense

Author: S. Beseau Date: May 2019 Source: Spokane Open GIS Data, ESRI

Spokane Crime Data 2014 Heat Map Analysis



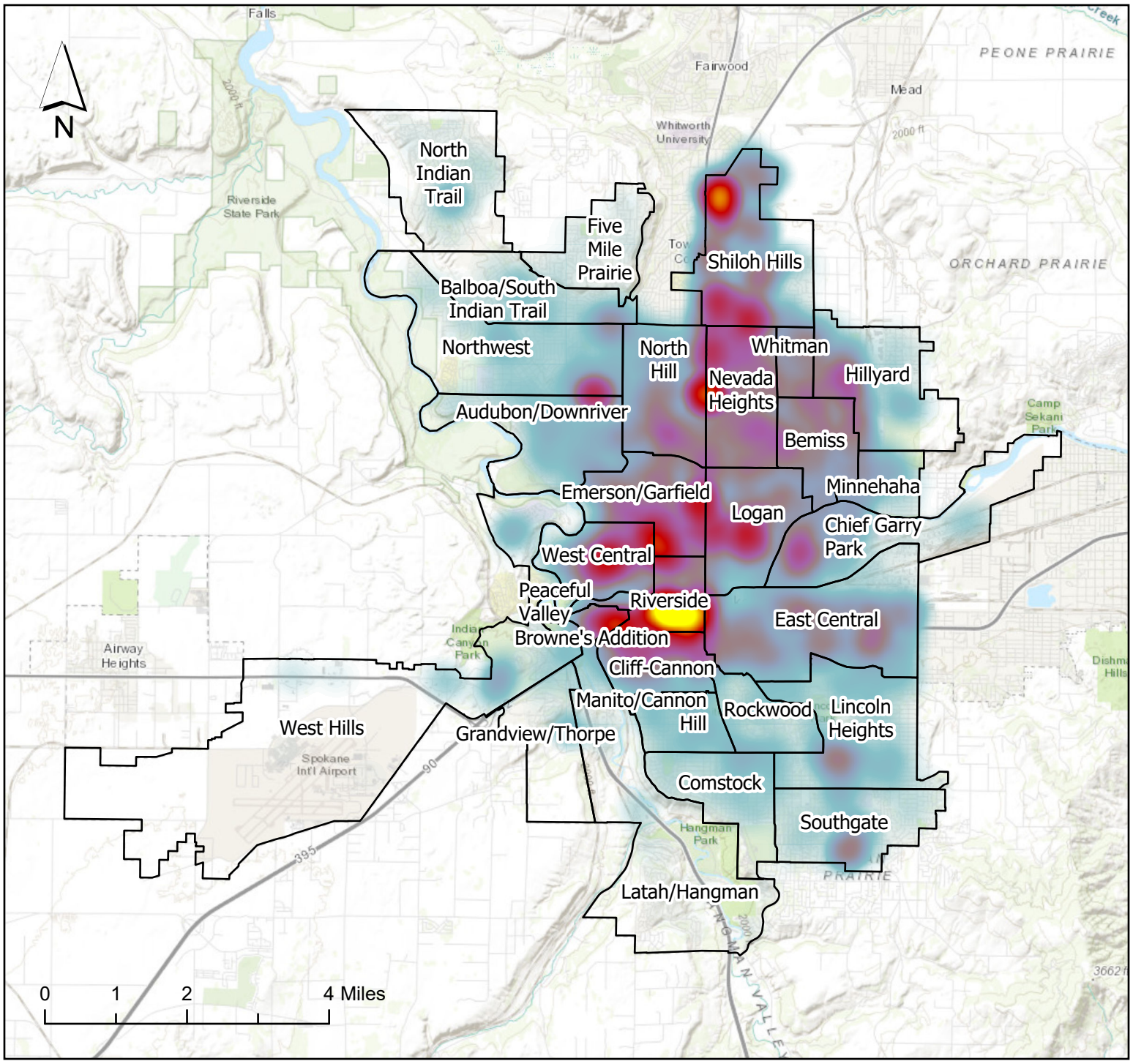
Neighborhood

Sparse

Dense

Author: S. Beseau Date: May 2019 Source: Spokane Open GIS Data, ESRI

Spokane Crime Data 2015 Heat Map Analysis



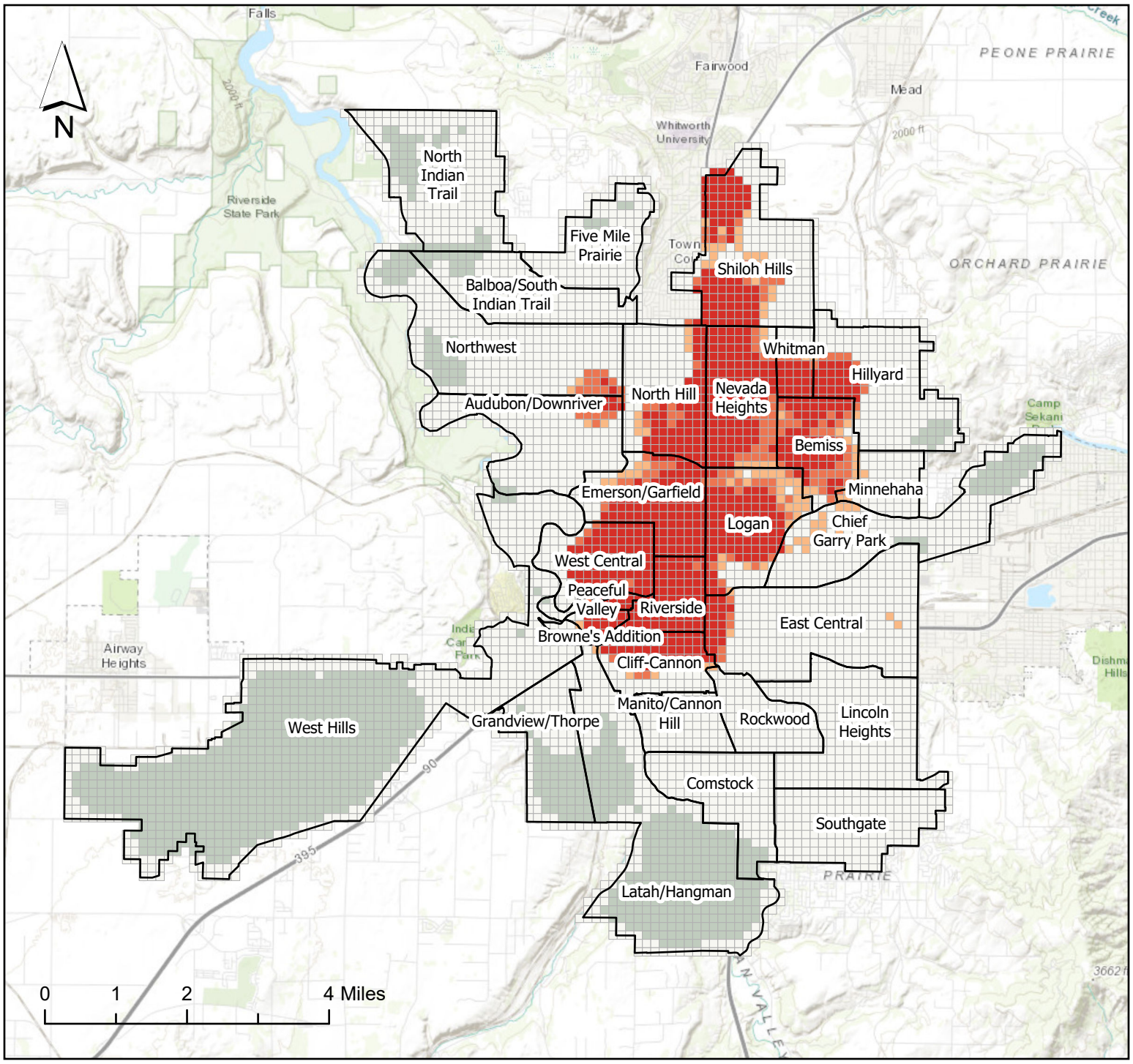
Neighborhood

Sparse

Dense

Author: S. Beseau Date: May 2019 Source: Spokane Open GIS Data, ESRI

Spokane Crime Data 2013 Optimized Hot Spot Analysis

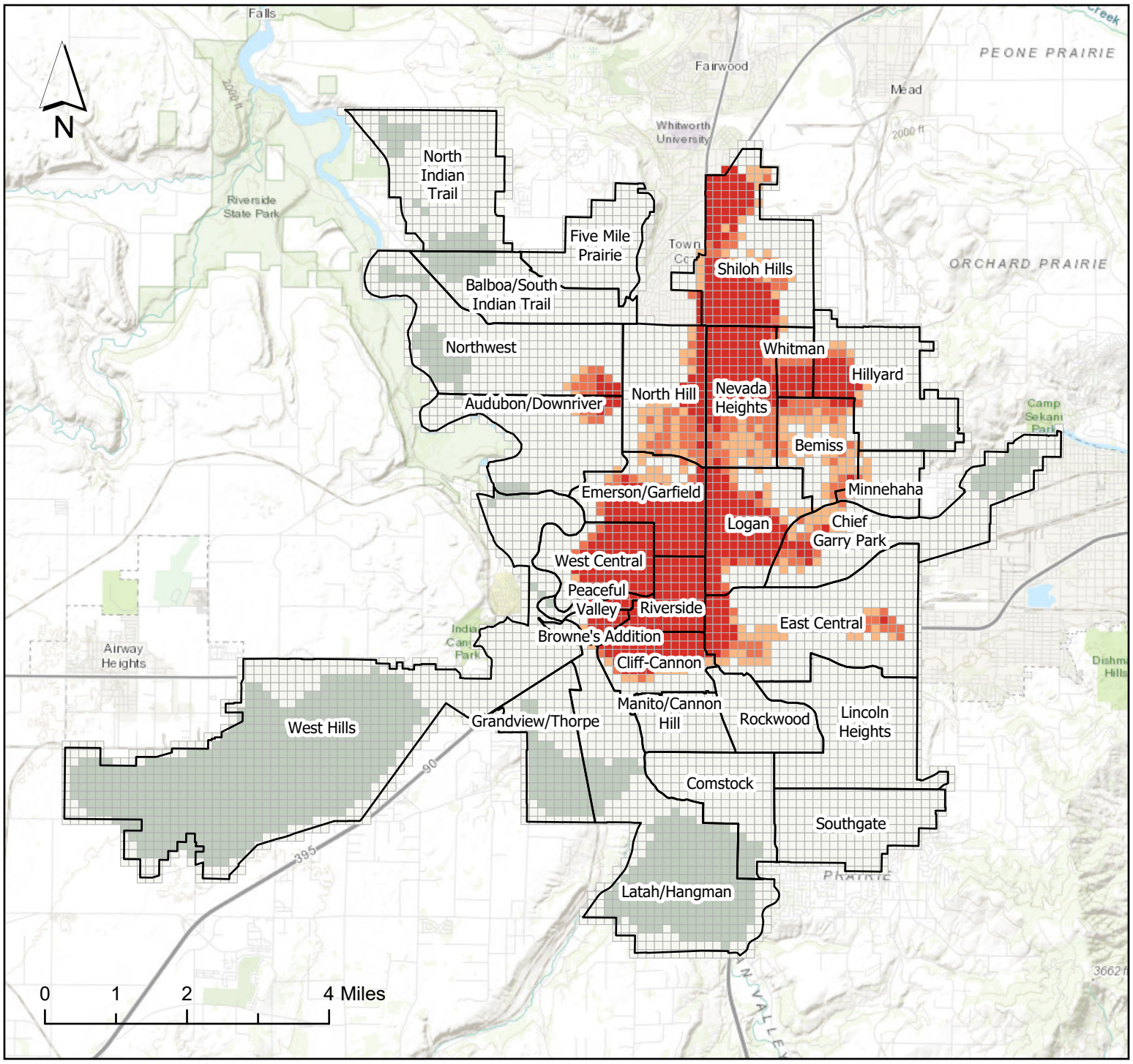


2013 Optimized Hot Spots

- Cold Spot - 99% Confidence
- Cold Spot - 95% Confidence
- Cold Spot - 90% Confidence
- Not Significant
- Hot Spot - 90% Confidence
- Hot Spot - 95% Confidence
- Hot Spot - 99% Confidence
- Neighborhood

Author: S. Beseau Date: May 2019 Source: Spokane Open GIS Data, ESRI

Spokane Crime Data 2014 Optimized Hot Spot Analysis

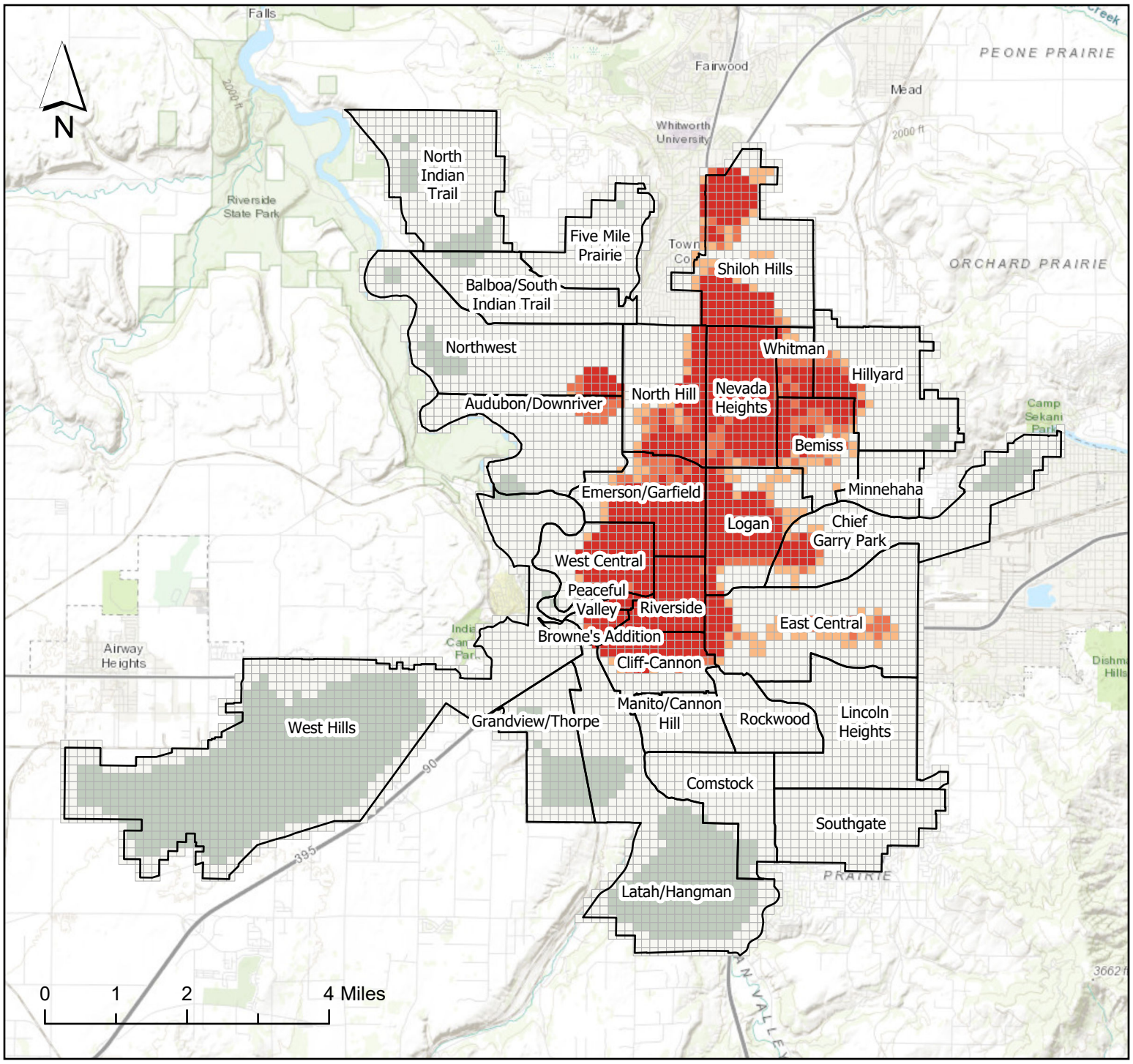


2014 Optimized Hot Spots

- Cold Spot - 99% Confidence
- Cold Spot - 95% Confidence
- Cold Spot - 90% Confidence
- Not Significant
- Hot Spot - 90% Confidence
- Hot Spot - 95% Confidence
- Hot Spot - 99% Confidence
- Neighborhood

Author: S. Beseau Date: May 2019 Source: Spokane Open GIS Data, ESRI

Spokane Crime Data 2015 Optimized Hot Spot Analysis

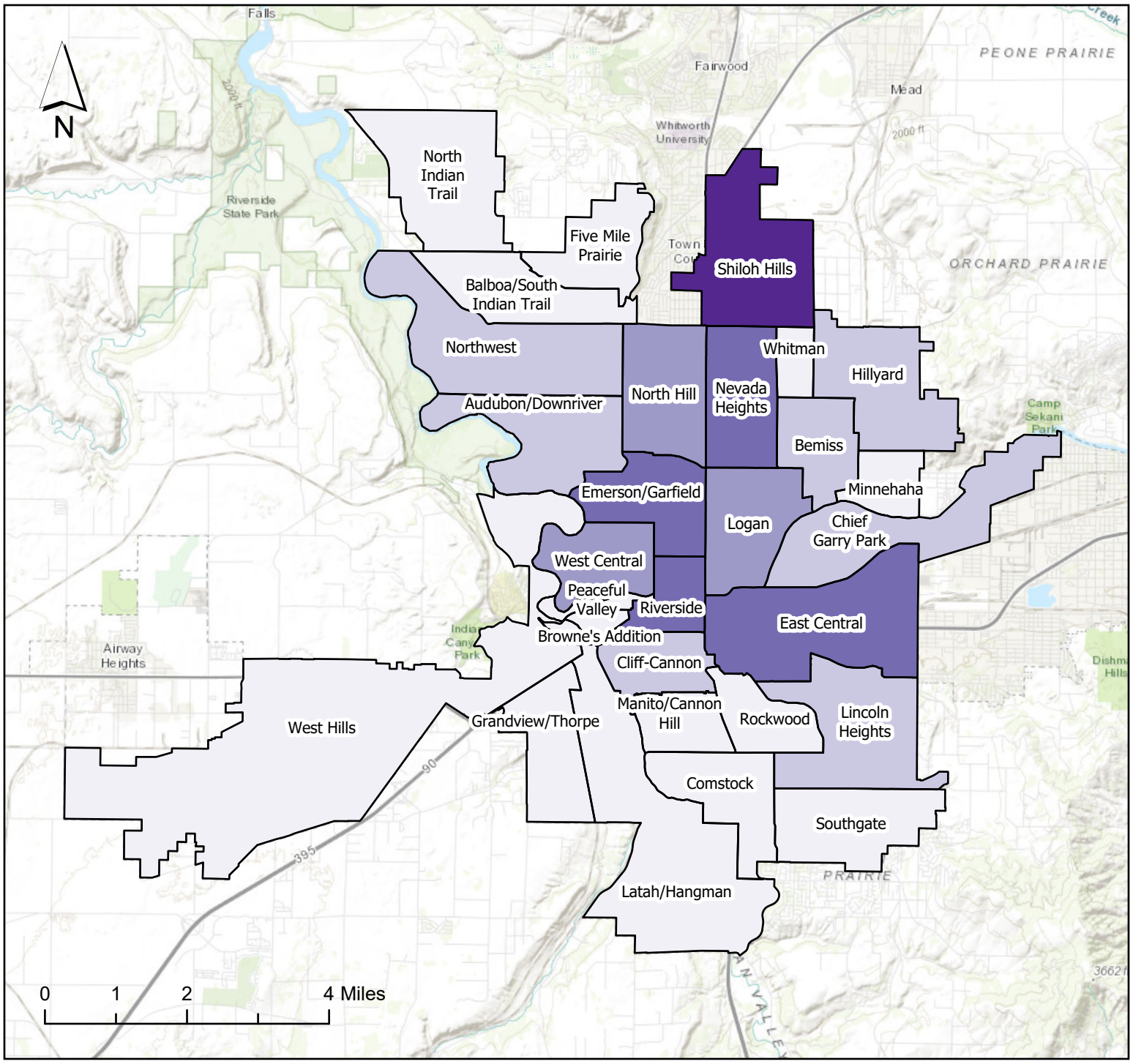


2015 Optimized Hot Spots

- Cold Spot - 99% Confidence
- Cold Spot - 95% Confidence
- Cold Spot - 90% Confidence
- Not Significant
- Hot Spot - 90% Confidence
- Hot Spot - 95% Confidence
- Hot Spot - 99% Confidence
- Neighborhood

Author: S. Beseau Date: May 2019 Source: Spokane Open GIS Data, ESRI

Spokane 2015 Total Crime by Neighborhood



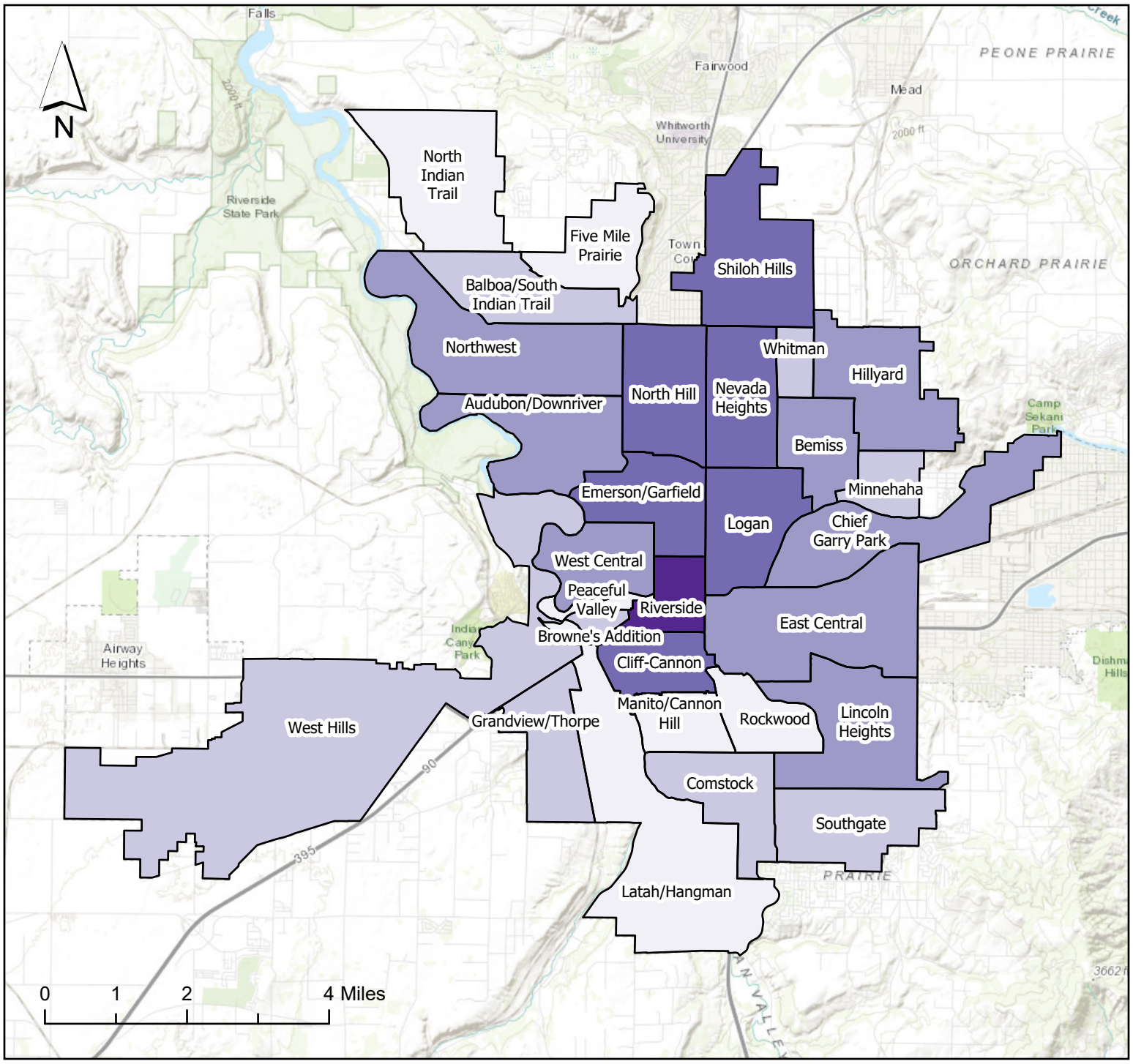
Neighborhood

Number of Crimes by Neighborhood

- ≤500
- ≤1000
- ≤1700
- ≤2200
- ≤2500

Author: S. Beseau Date: May 2019 Source: Spokane Open GIS Data, ESRI

Spokane 2015 Crime as Percent of Neighborhood Population



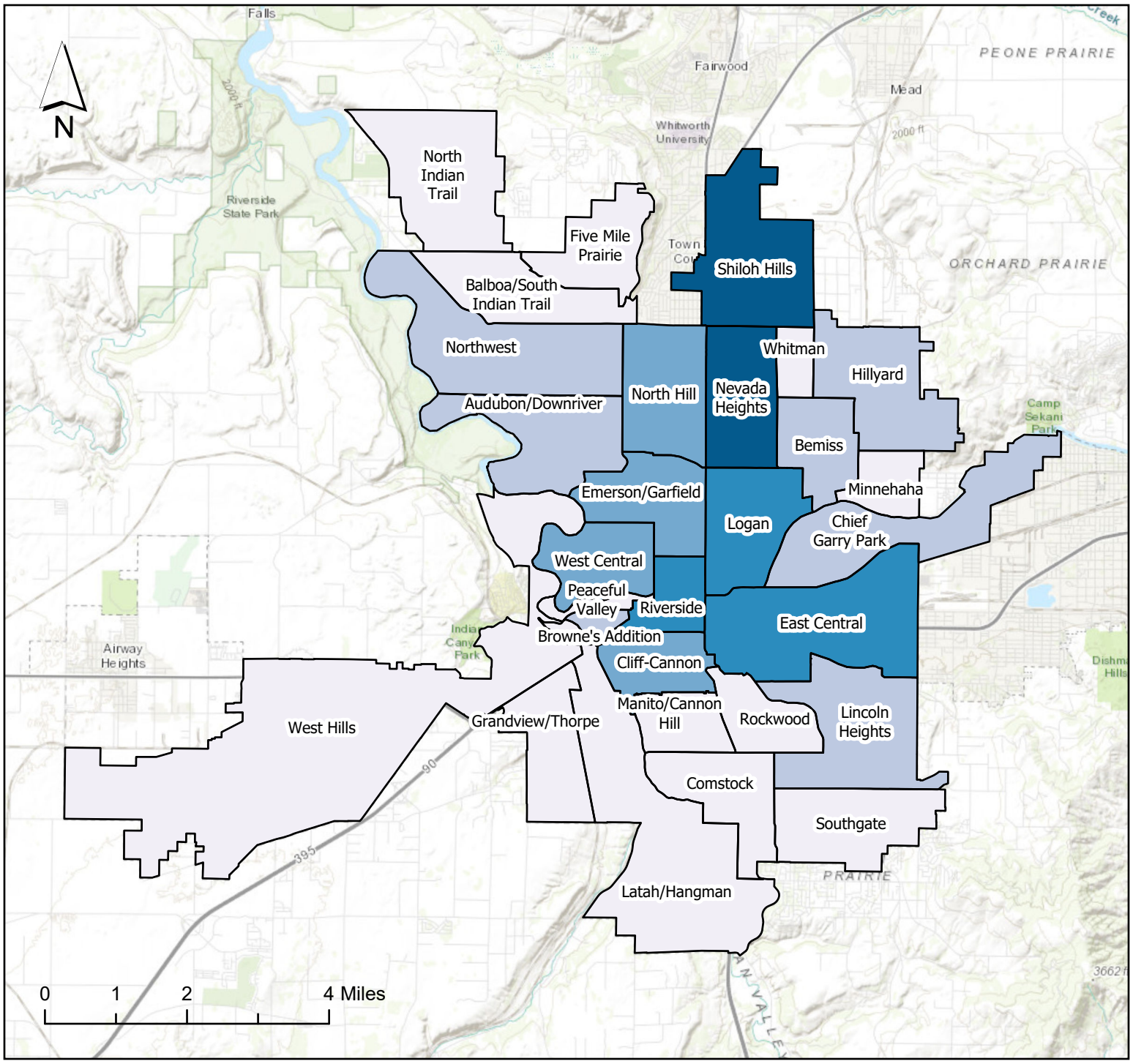
Neighborhood

Percent Crimes by Neighborhood Population

- ≤ 05%
- ≤ 15%
- ≤ 30%
- ≤ 70%
- ≤ 80%

Author: S. Beseau Date: May 2019 Source: Spokane Open GIS Data, US Census 2010, ESRI

Spokane 2013 Total Thefts by Neighborhood



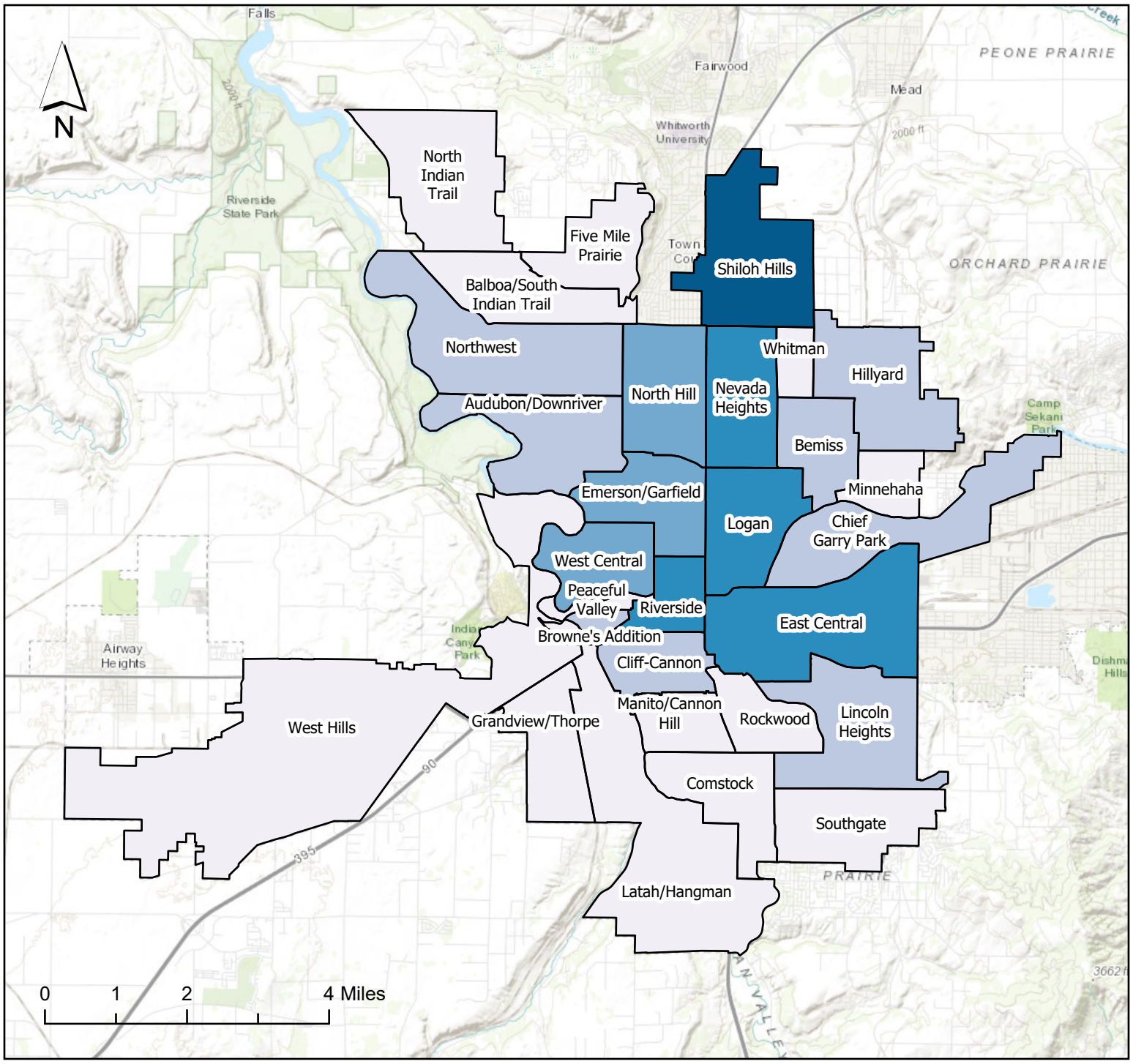
Neighborhood

Thefts

- ≤100
- ≤250
- ≤500
- ≤750
- ≤1000

Author: S. Beseau Date: May 2019 Source: Spokane Open GIS Data, ESRI

Spokane 2014 Total Thefts by Neighborhood



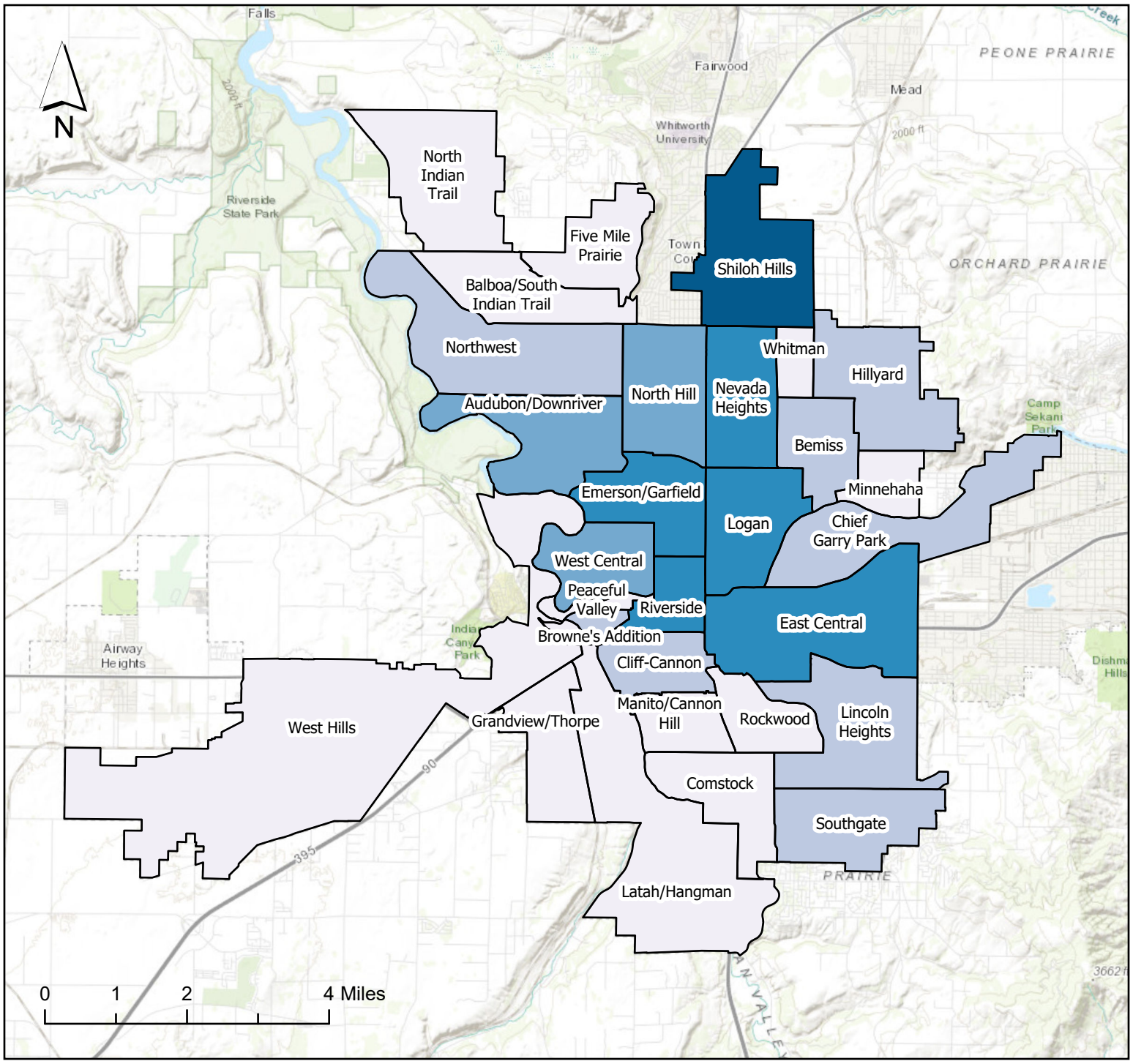
Neighborhood

Thefts

- ≤100
- ≤250
- ≤500
- ≤750
- ≤1000

Author: S. Beseau Date: May 2019 Source: Spokane Open GIS Data, ESRI

Spokane 2015 Total Thefts by Neighborhood



Neighborhood

Thefts

- ≤100
- ≤250
- ≤500
- ≤750
- ≤1000

Author: S. Beseau Date: May 2019 Source: Spokane Open GIS Data, ESRI