

# Spatiotemporal Hotspot Analysis for Crime Record in Atlanta before and after Covid Shutdown

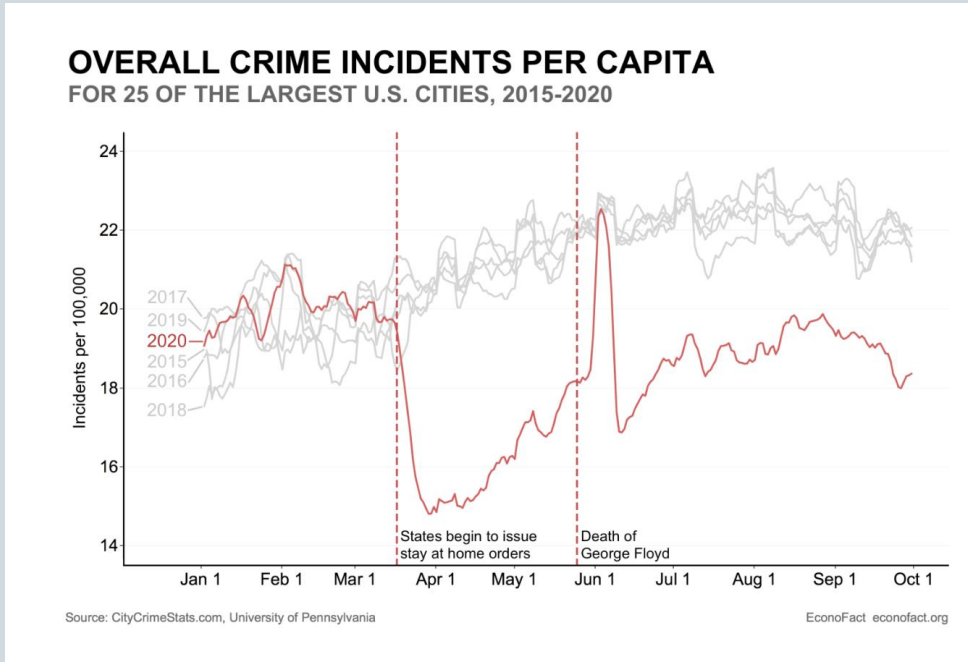
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# Background – Covid Outbreak and Shutdown

On **March 15, 2020**, the United States began to implement shutdowns to prevent the spread of the virus. (CDC Museum COVID-19 Timeline)



The overall drop in crime corresponds with a drop in the population's mobility

- Crime Type Changes

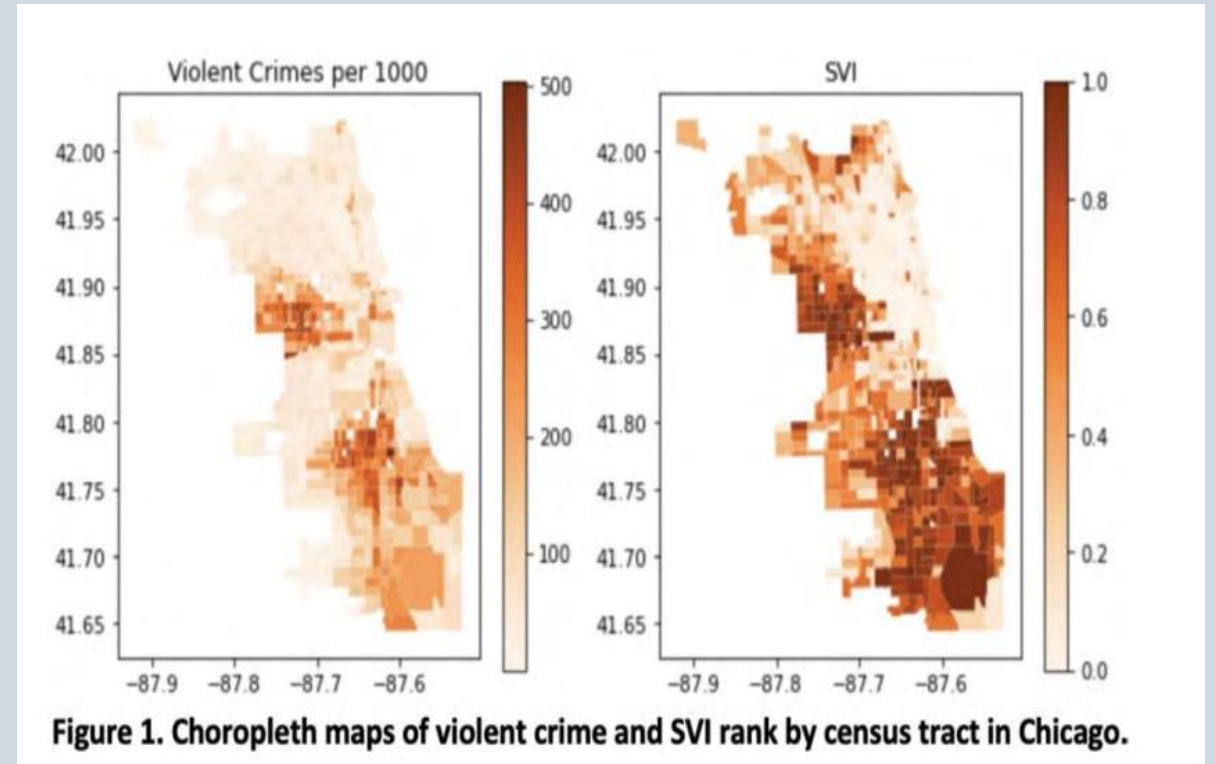
Home burglaries dropped while commercial burglaries and car thefts rose.

There were substantial increases in homicides and shootings beginning in the summer of 2020

The pandemic in the U.S. in 2020 had a massive impact on crime – with overall crime falling by over 23%

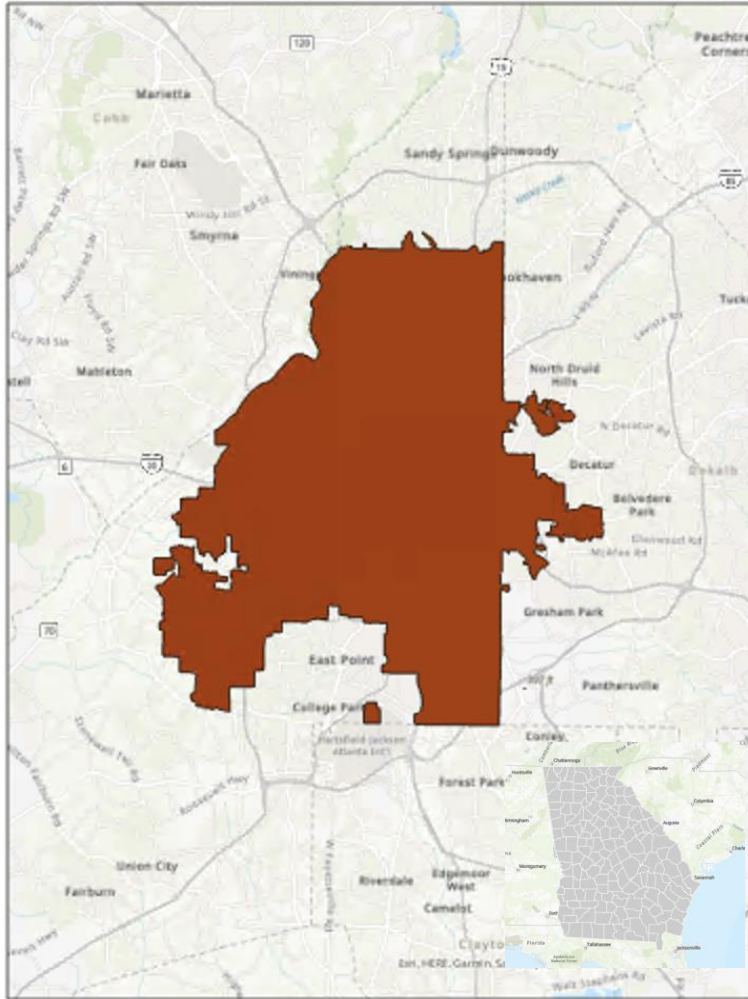
# Background – SVI and Violent Crime

- The Social Vulnerability Index (SVI), composed social factors, is used to predict communities most at risk for negative consequences during natural disasters and public health crises.
- The first study to demonstrate relationship between SVI data with violent crimes (assault, battery, and homicide)
- The result shows SVI may predict community risk for violence.



Polcari, A. M., Slidell, M. B., Nordgren, R., Hoefer, L. E., Zakrison, T. L., & Benjamin, A. J. (2022). Social vulnerability index predicts violent crime in Chicago.

## Study Area: Atlanta City, Georgia



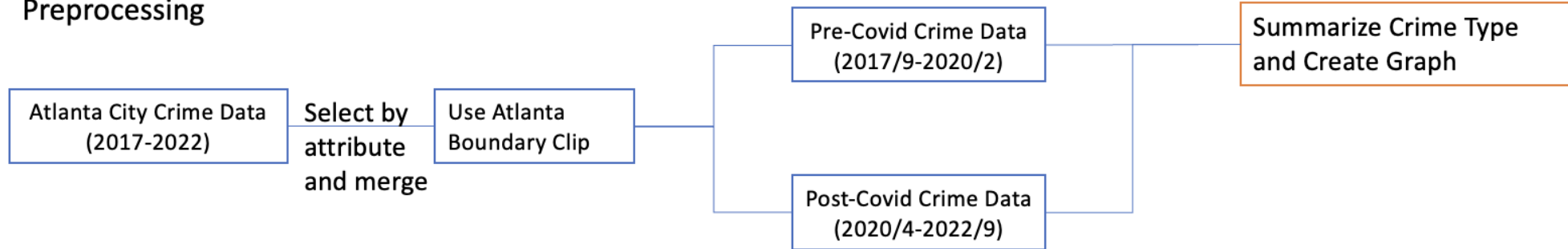
### Research Question:

1. How the crime rate and type changed in Atlanta after Covid shutdown?
2. What changed in crime hotspots?
3. Is there a relationship between the violent crime rate (assault and homicide) and SVI in the Atlanta area?

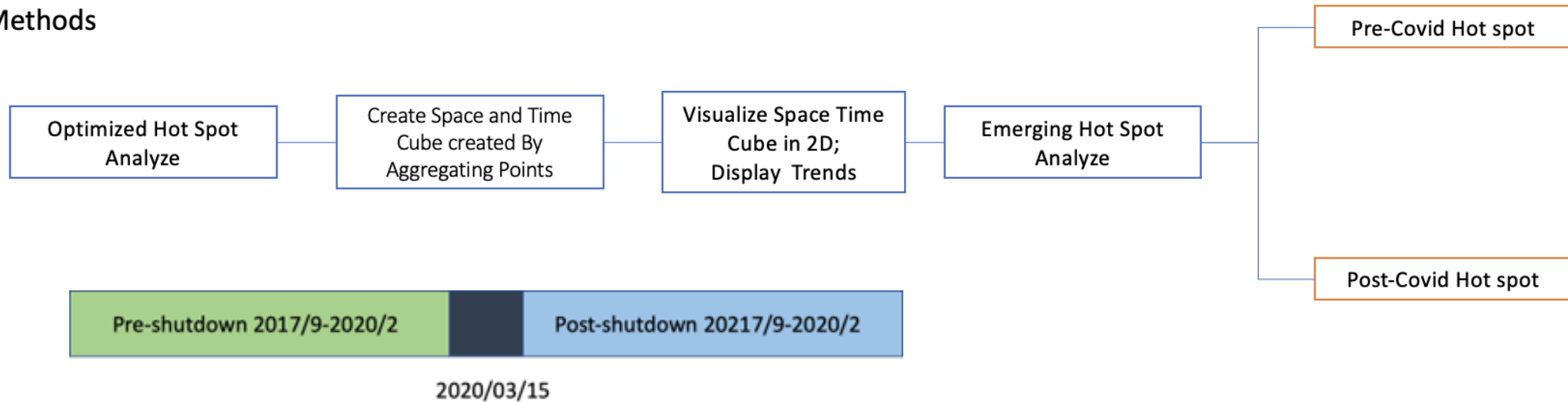
# Data

Data Layers	Source	Description
Atlanta City boundary	<a href="#">ARC Open Data &amp; Mapping Hub</a>	County level Polygon .shp file (clipped from Georgia range to Atlanta city)
Atlanta City Crime Data 2017-2022	<a href="#">Atlanta Police Department Website (atlantapd.org)</a>	CSV data with lat/long coordinate. Add it to map by “Add X, Y point data to map”
2018 and 2020 CDC Social Vulnerability Index in Atlanta City	<a href="#">Agency for Toxic Substances and Disease Registry (ATSDR)</a>	Census tract level polygon .shp file (clipped from Georgia range to Atlanta city)

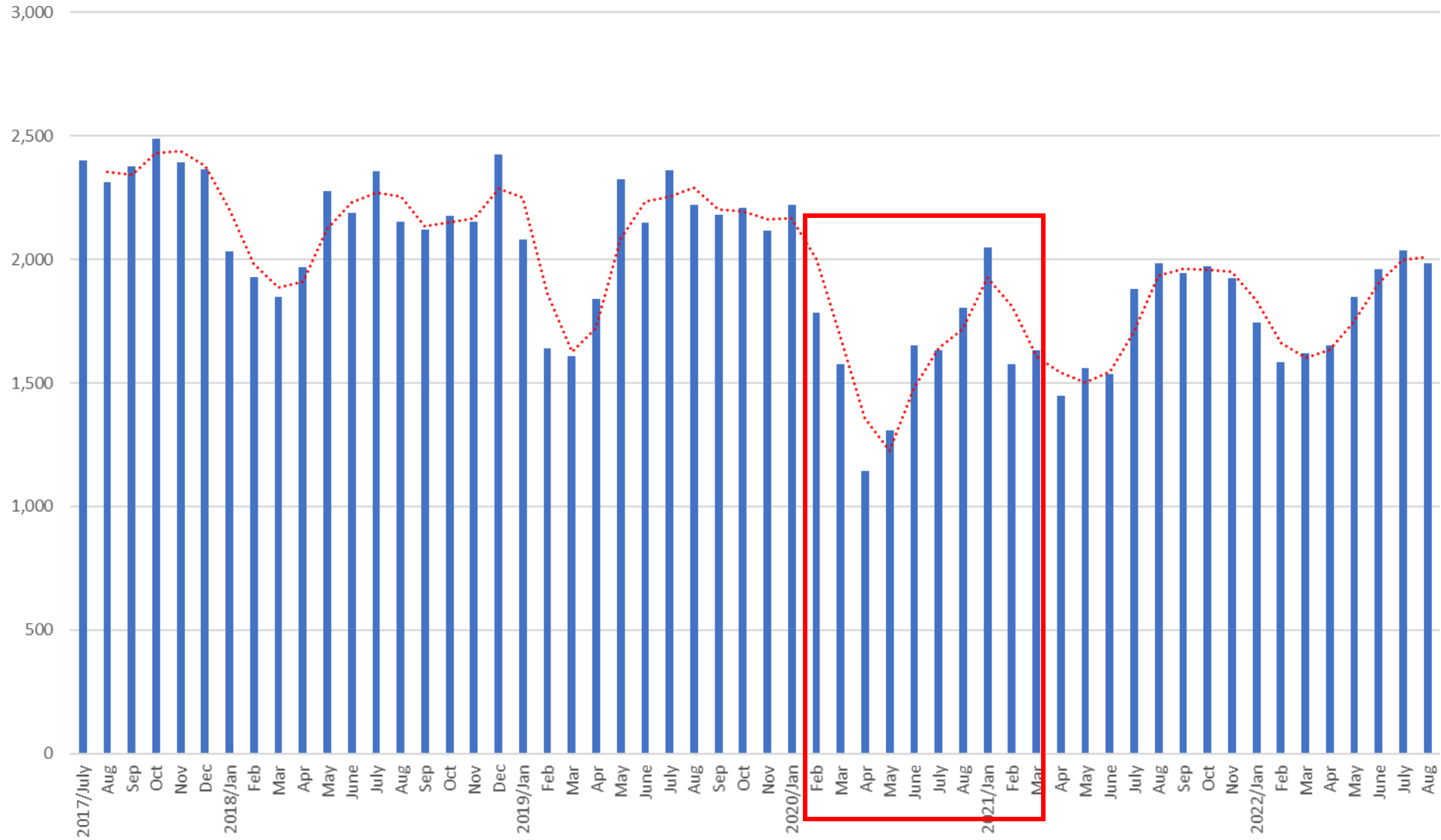
## Preprocessing

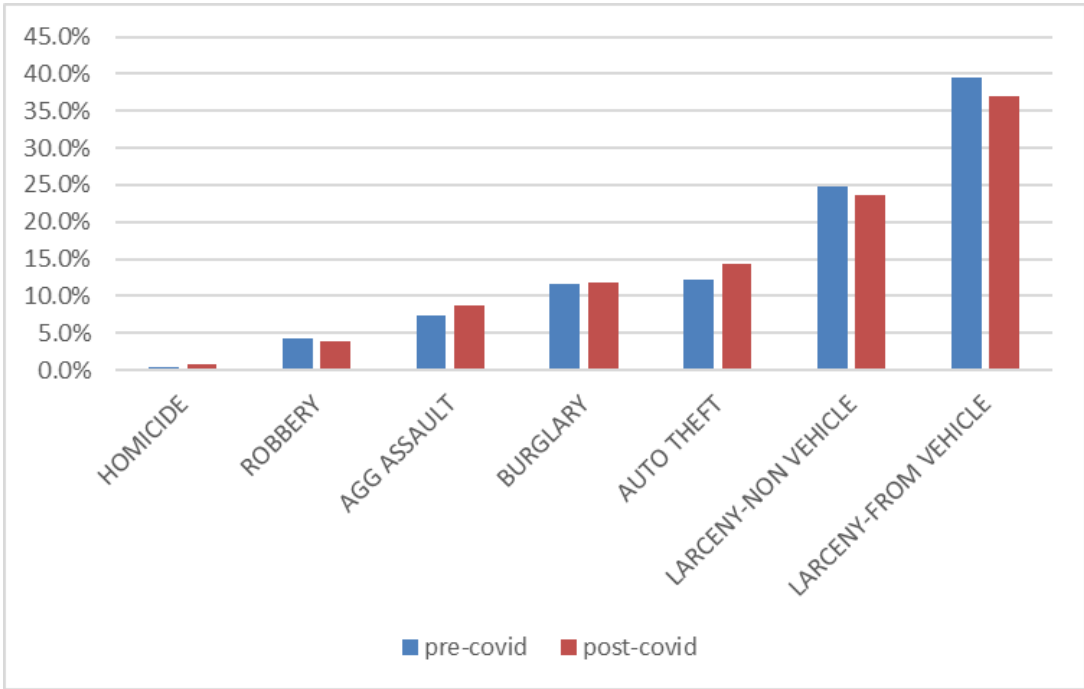


## Methods

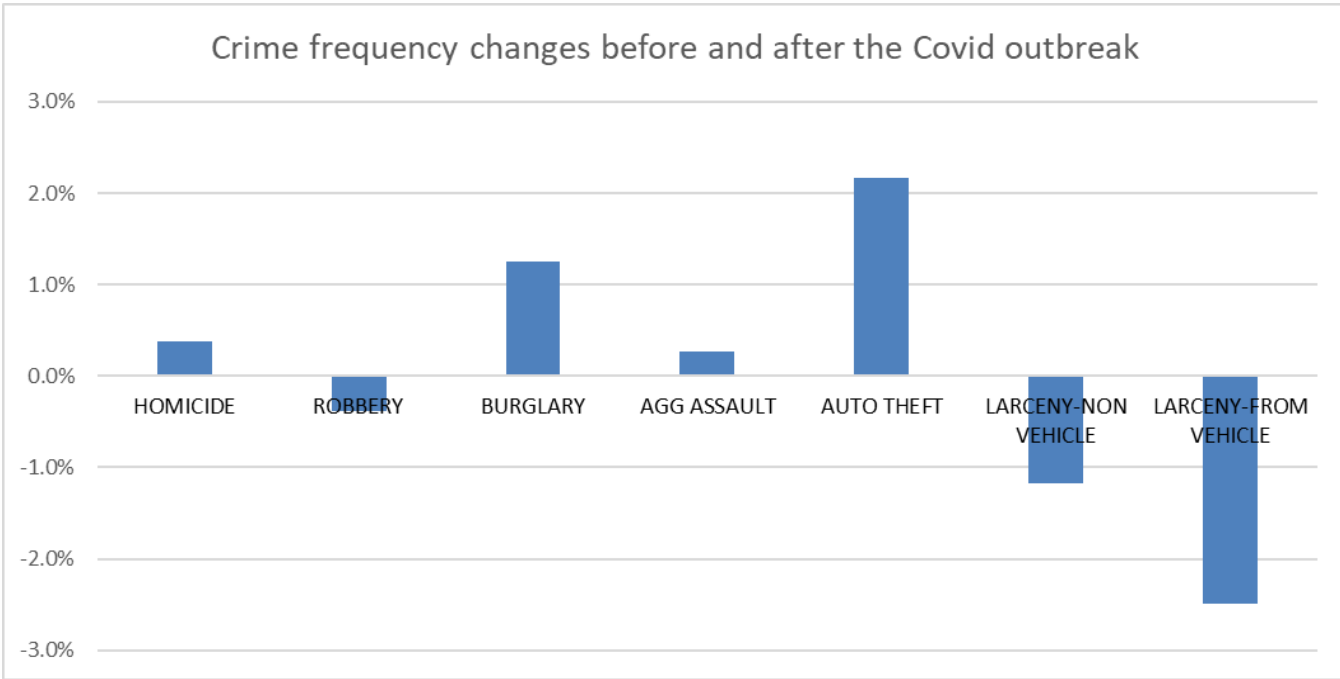


Atlanta Crime Rate 2017 July - 2022 Aug



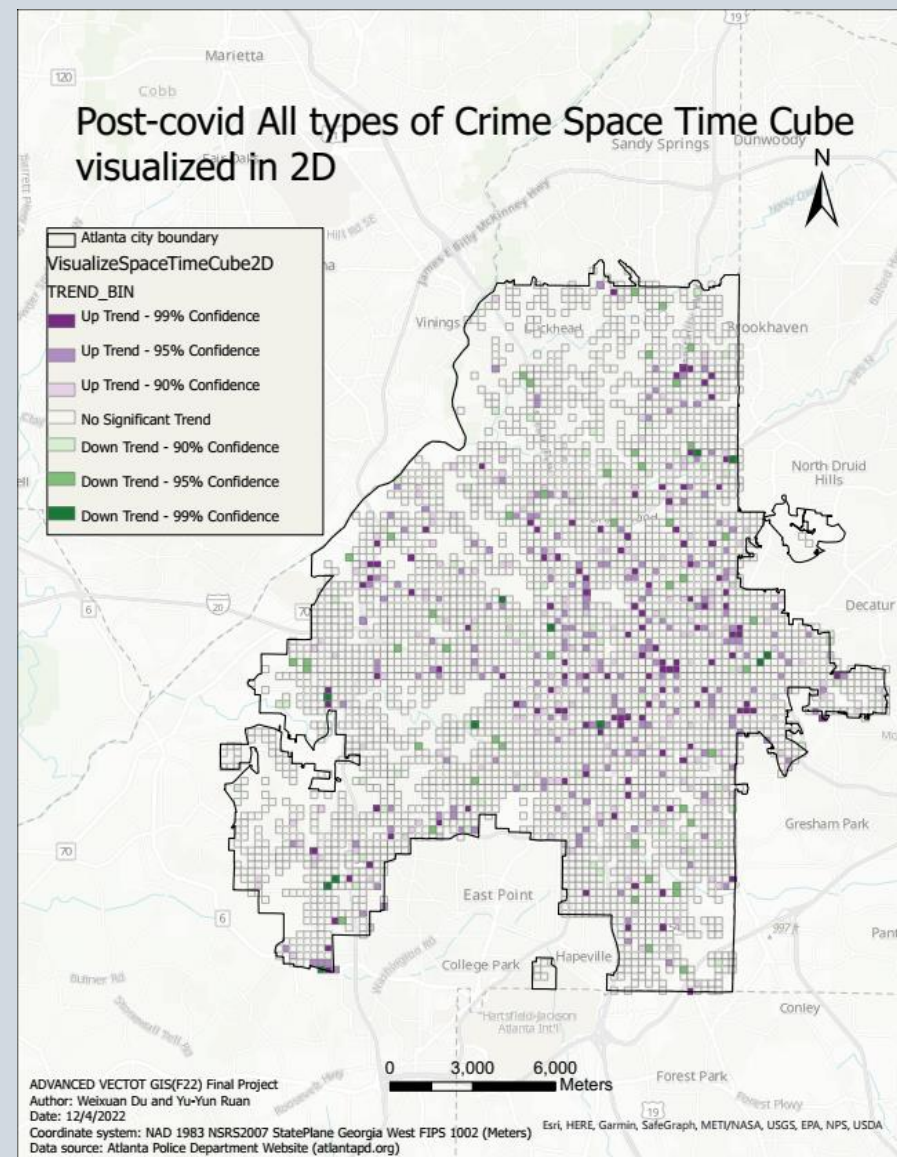
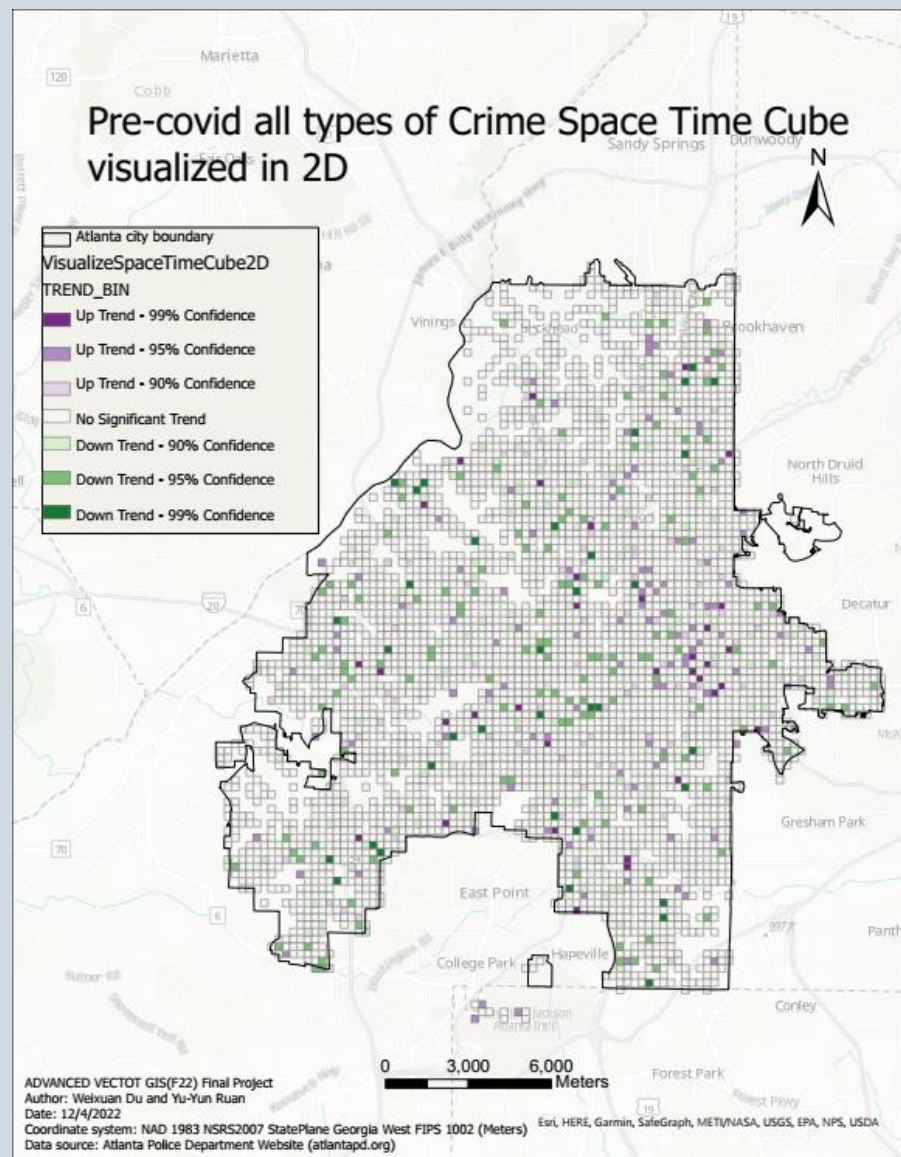


Percentage of Crime Frequency before and after Covid shutdown



Changes in crime frequency before and after the Covid outbreak compared by crime category







## Pre-covid all types of Crime Hot Spot Analysis



### Pattern Type COUNT FREQUENCY

Consecutive Cold Spot	20
Consecutive Hot Spot	7
Diminishing Cold Spot	1
Diminishing Hot Spot	141
Historical Hot Spot	4
Intensifying Cold Spot	227
Intensifying Hot Spot	193
New Cold Spot	16
New Hot Spot	1
No Pattern Detected	1862
Persistent Cold Spot	150
Persistent Hot Spot	264
Sporadic Cold Spot	801
Sporadic Hot Spot	243

ADVANCED VECTOT GIS(F22) Final Project  
 Author: Weixuan Du and Yu-Yun Ruan  
 Date: 12/4/2022  
 Coordinate system: NAD 1983 NRS2007 StatePlane Georgia West FIPS 1002 (Meters)  
 Data source: Atlanta Police Department Website (atlantapd.org)

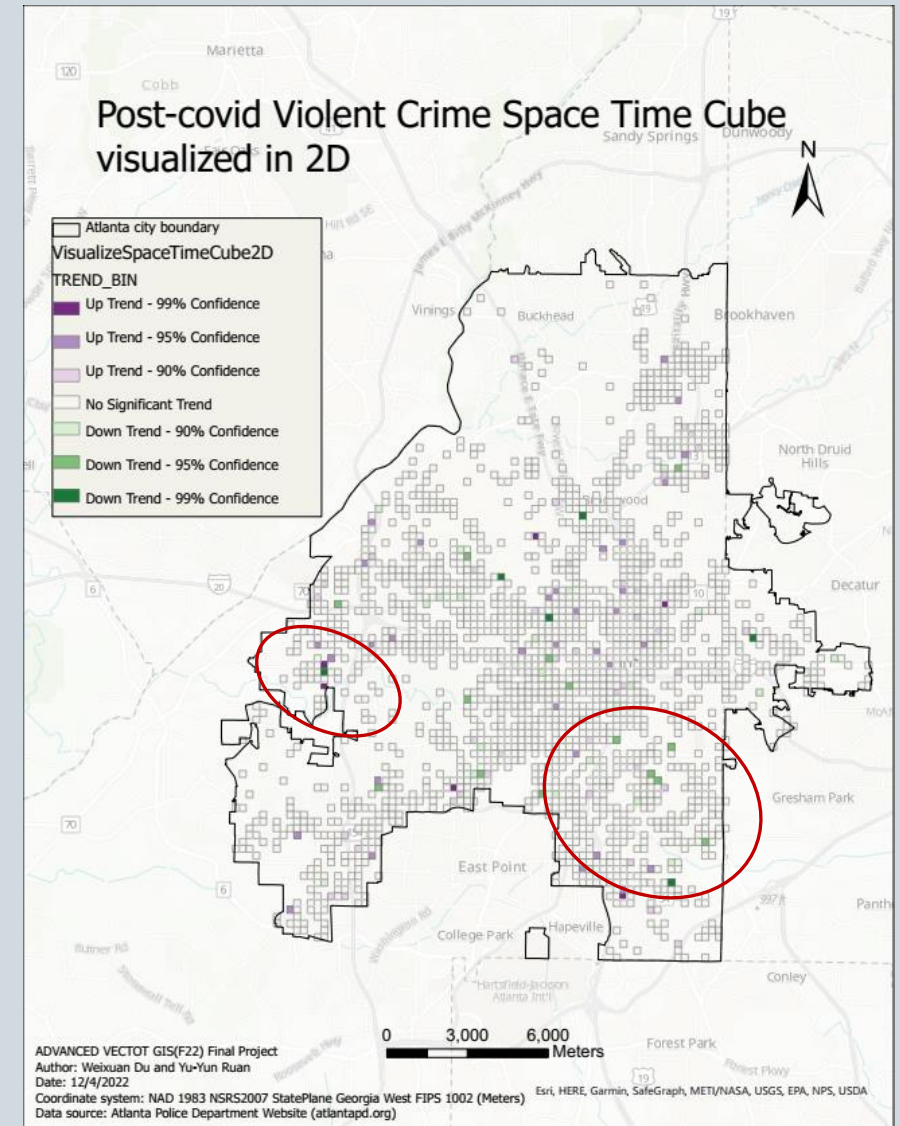
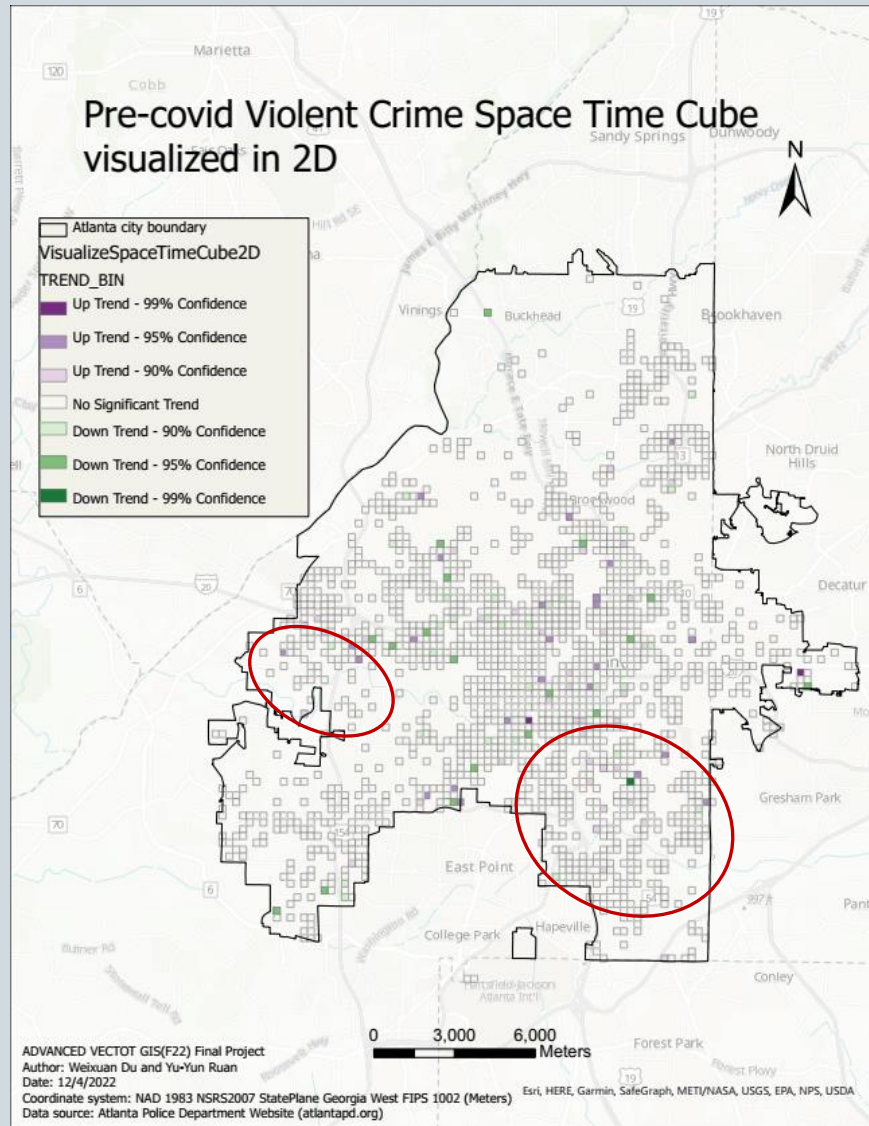
## Post-covid All types of Crime Hot Spot Analysis



### Pattern Type COUNT FREQUENCY

Diminishing Cold Spot	219
Historical Cold Spot	12
Intensifying Cold Spot	171
Intensifying Hot Spot	317
New Hot Spot	20
No Pattern Detected	2510
Oscillating Hot Spot	1118
Persistent Cold Spot	1110
Persistent Hot Spot	36
Sporadic Cold Spot	381

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## Pre-covid Violent Crime Hot Spot Analysis

Atlanta city, GA  
Violent Crime frequency Hot Spot  
(2017 Sep to 2020 Feb)

- New Hot Spot
- Consecutive Hot Spot
- Intensifying Hot Spot
- Persistent Hot Spot
- Diminishing Hot Spot
- Sporadic Hot Spot
- Oscillating Hot Spot
- Historical Hot Spot
- No Pattern Detected

### Pattern Type COUNT FREQUENCY

Consecutive Hot Spot	1
Diminishing Hot Spot	2
Historical Hot Spot	15
Intensifying Hot Spot	66
New Hot Spot	2
No Pattern Detected	5268
Persistent Hot Spot	139
Sporadic Hot Spot	324

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## Post-covid Violent Crime Hot Spot Analysis

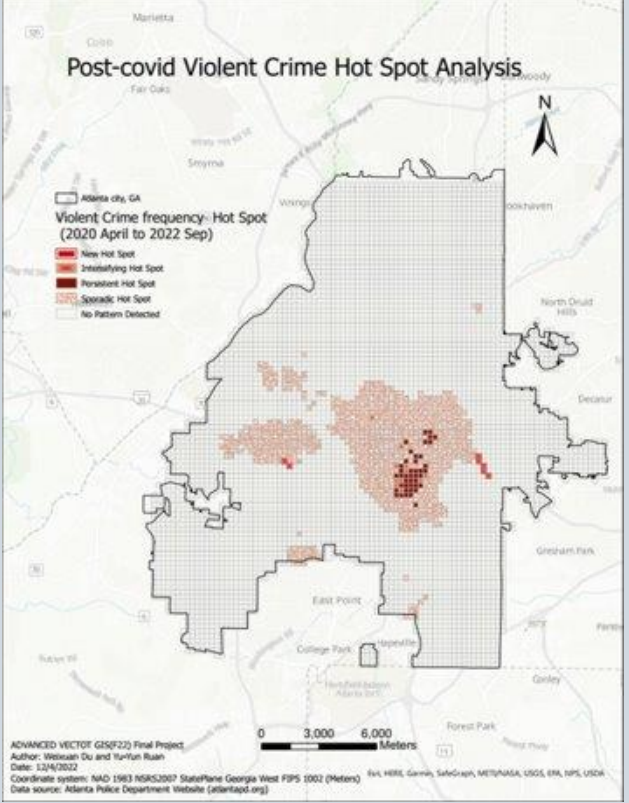
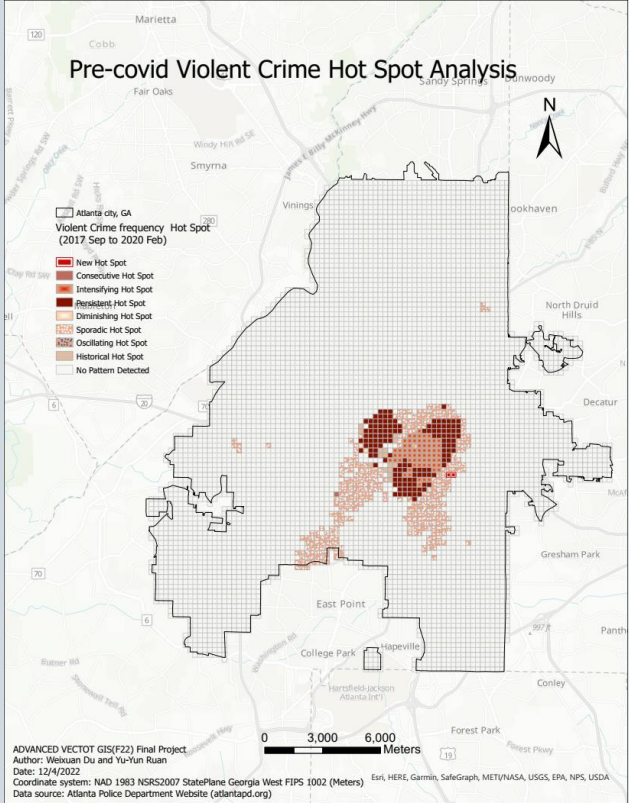
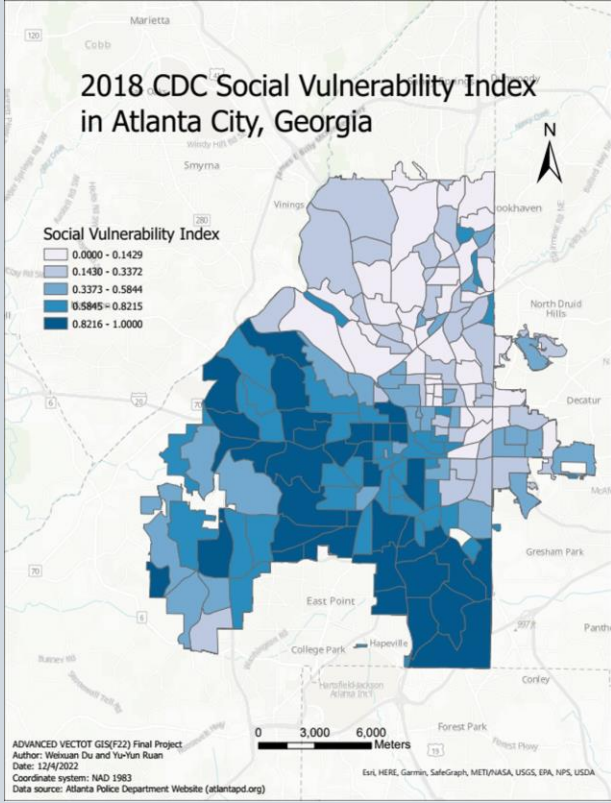
Atlanta city, GA  
Violent Crime frequency Hot Spot  
(2020 April to 2022 Sep)

- New Hot Spot
- Intensifying Hot Spot
- Persistent Hot Spot
- Sporadic Hot Spot
- No Pattern Detected

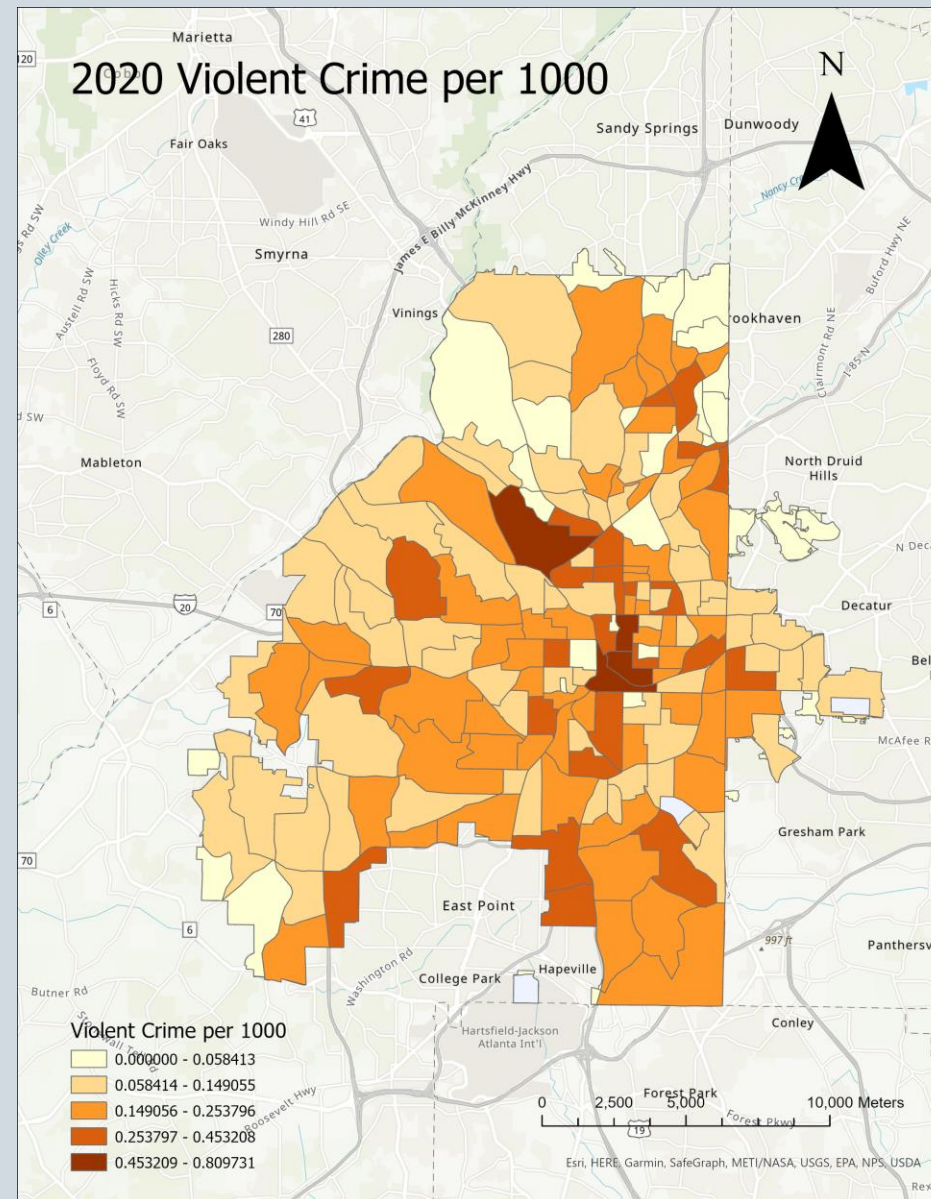
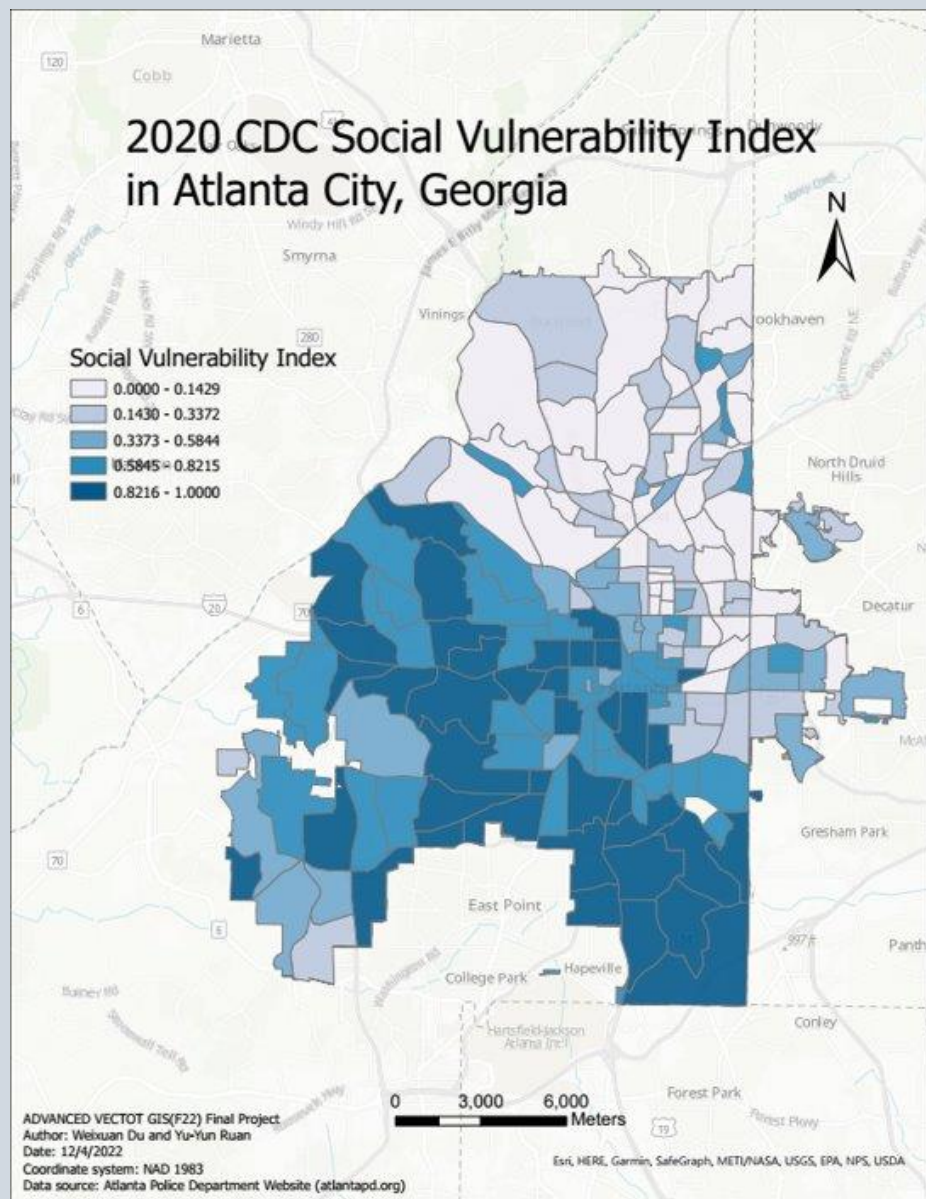
### Pattern Type COUNT FREQUENCY

Intensifying Hot Spot	11
New Hot Spot	7
No Pattern Detected	4987
Persistent Hot Spot	42
Sporadic Hot Spot	729

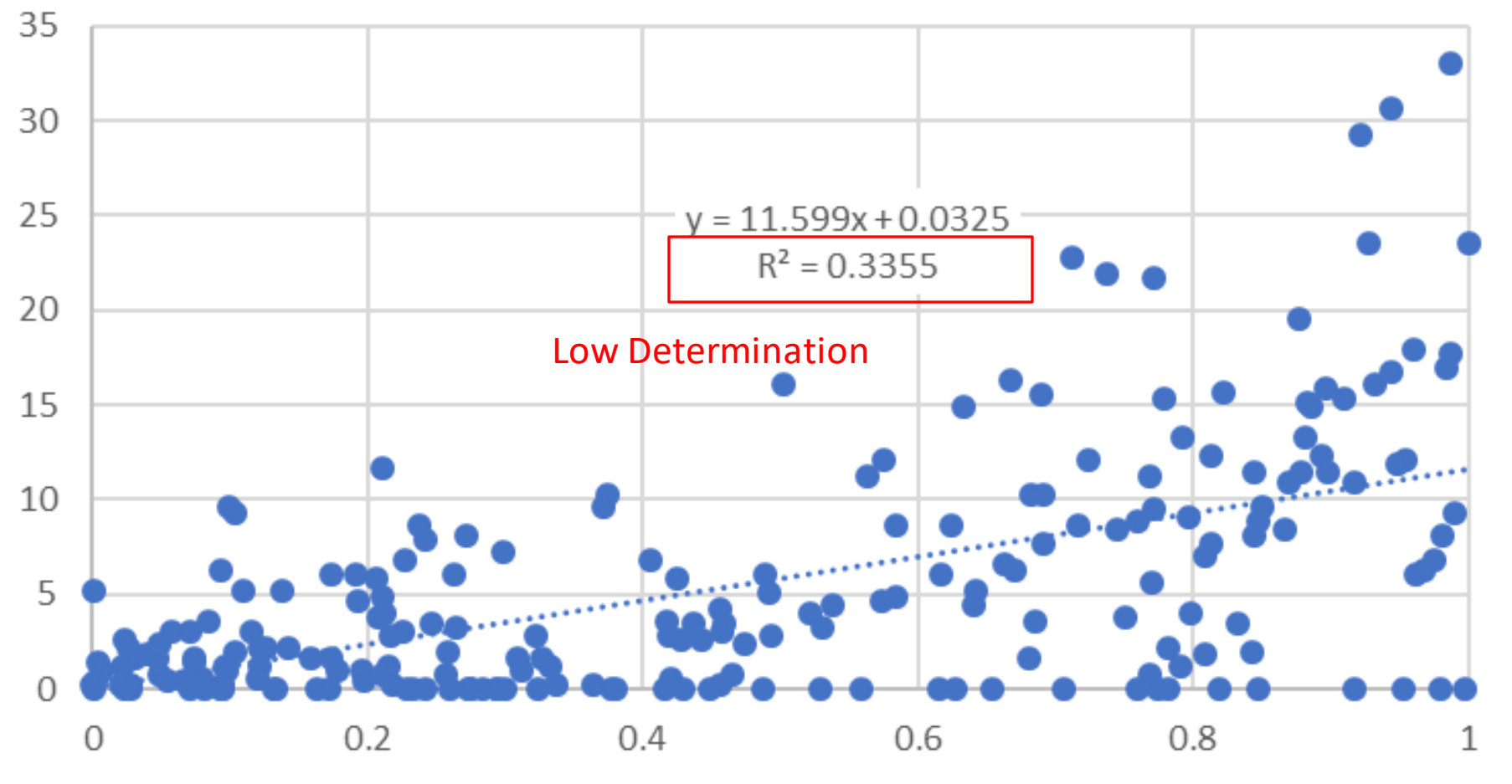
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## Violent Crime Rate versus SVI in 2020



# Conclusion

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1. The crime rate in the Atlanta area decreased after the shutdown, and the ratio of crime types also changed: violent crime increased while Crime of theft decreased. This trend is similar to the overall crime change in the United States.
2. The distribution of hot spots became wider after COVID-19 shutdown.
3. There was no significant determination between social vulnerability and violent crime in the Atlanta area.

# Future Work

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1. In the analysis of spatiotemporal hotspots of crime rates, there may be different changes compared with shorter time.
  2. In this study, the connection between SVI and the rate of violent crime is not significant.
- Try longer period
  - More study areas



## Reference

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