Jonesboro Crime Distribution:
Spatial Distribution and Contributing Factors

Study Results
Presented to the City Council, Jonesboro, AR
Public Safety Committee
June 12, 2012

Basia Combs, Crime Analyst
Jonesboro Police Department
Office of Crime Analysis & Criminal Intelligence

6/18/2012

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Executive Summary

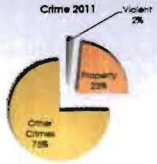
Crime in Jonesboro	• 2011 total reported incidents: 20,267
Crime and Place	• Spatial distribution of Crime in Jonesboro – Hot Spots
Research	• Spatial relationship • Multiple Regression
Contributing Factors	• Results
Recommendations	• City • JPD

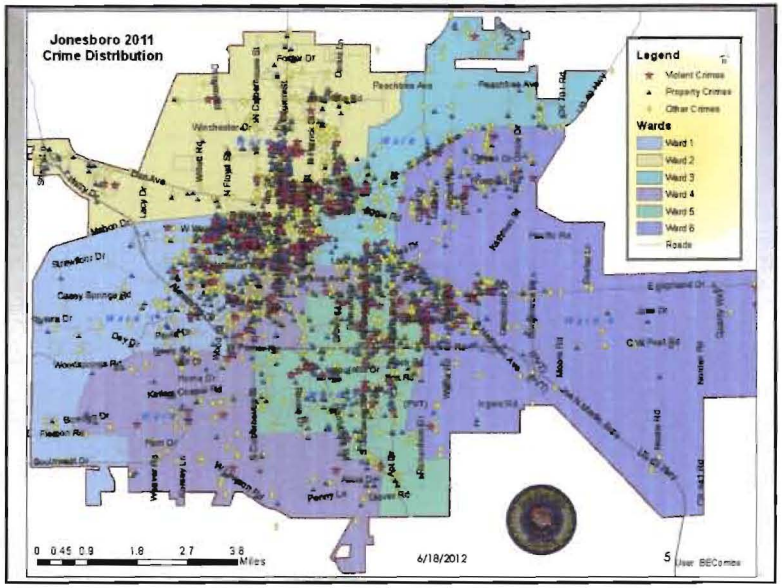
Jonesboro Crime 2011

Violent Crimes (*n* = 313)
- Willful Homicide
- Forcible Rape
- Aggravated Assaults
- Robbery

Property Crimes (n = 4,726)
- Larceny/Theft
- Motor Vehicle Theft
- Burglary
- Arson

Other Crimes (*n* = 15,228)
- Crimes of Proactive Policing
- All Other Crimes





Spatial Density Maps

Kernel Density

- Kernel density mapping is a Geographic Information Systems (GIS) analysis technique that creates a continuous surface map based on point data
- Density surfaces are effective at identifying where features are **concentrated** – highlighting areas of intense activity
- These **areas of intense activity are called hot spots**
- **Hot spot analysis** helps police identify high-crime areas, types of crime being committed, and the best way to respond

The procedure for creating a kernel density map surface is:

- An invisible grid is laid over the study area
- A search radius is specified for the GIS to define the neighborhood around each cell center
- The number of features that fall within that neighborhood are counted and divided by that area
- The calculated value is assigned to the cell and the process is repeated This creates a running average of features per area to create a smoothed, continuous surface

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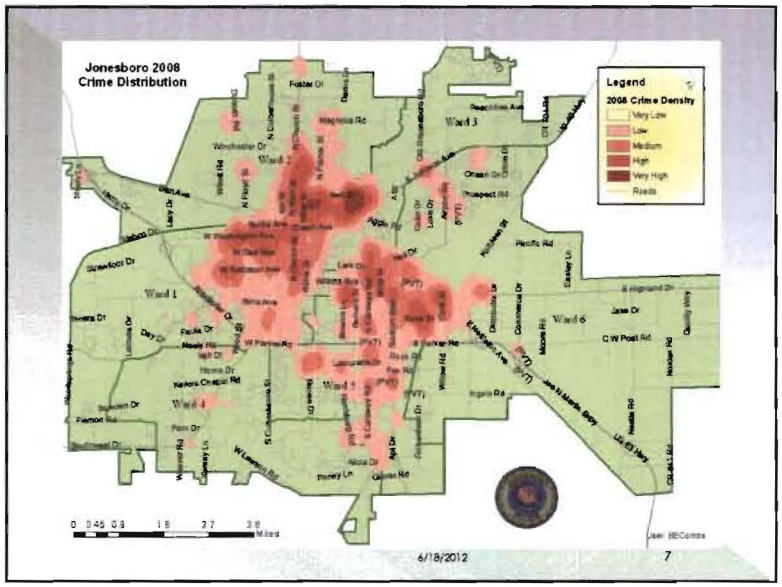

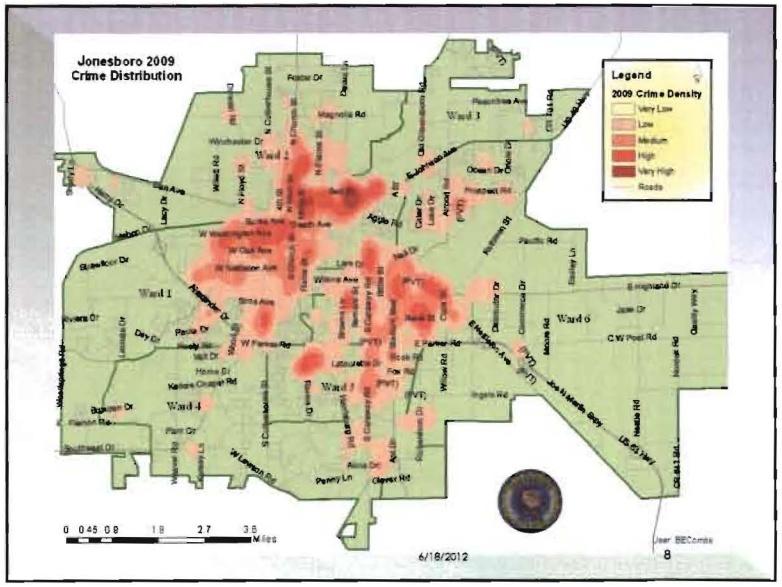

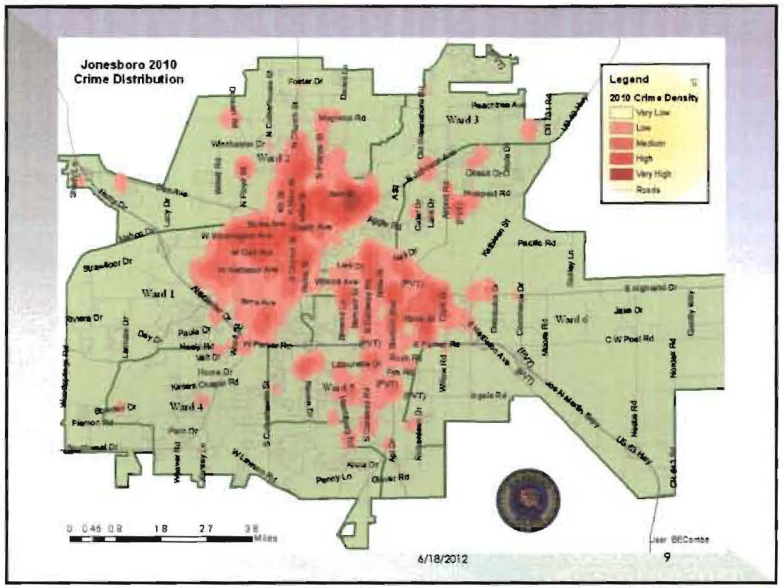

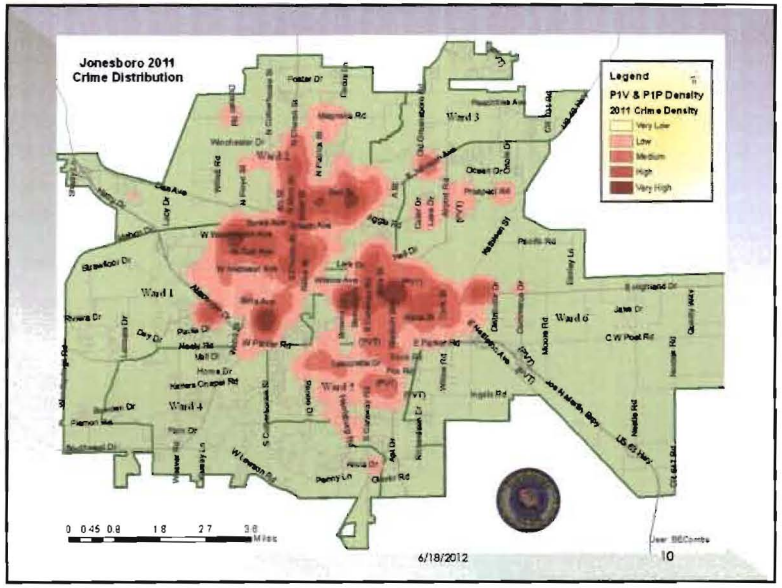

2011 Crime Distribution by Category

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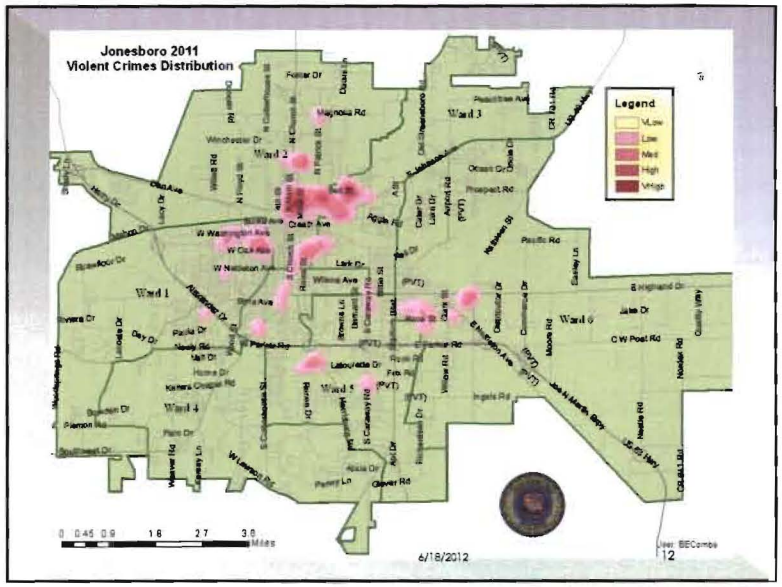
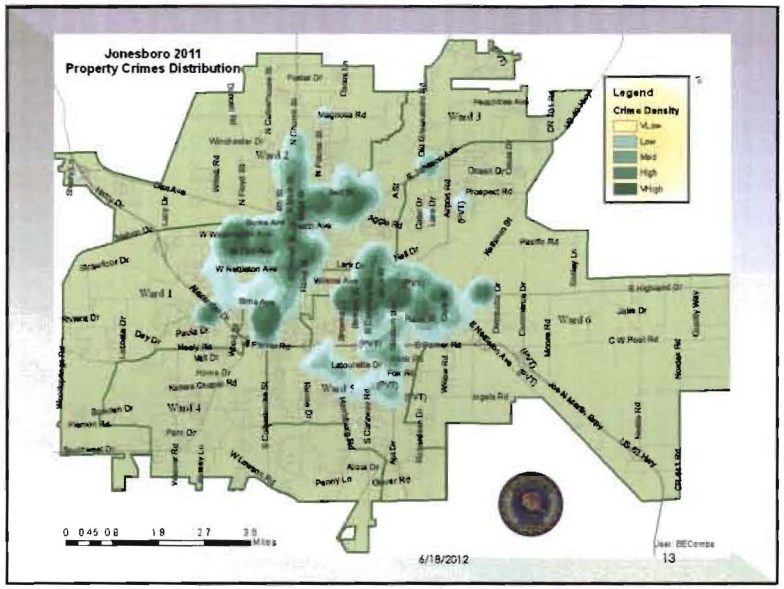
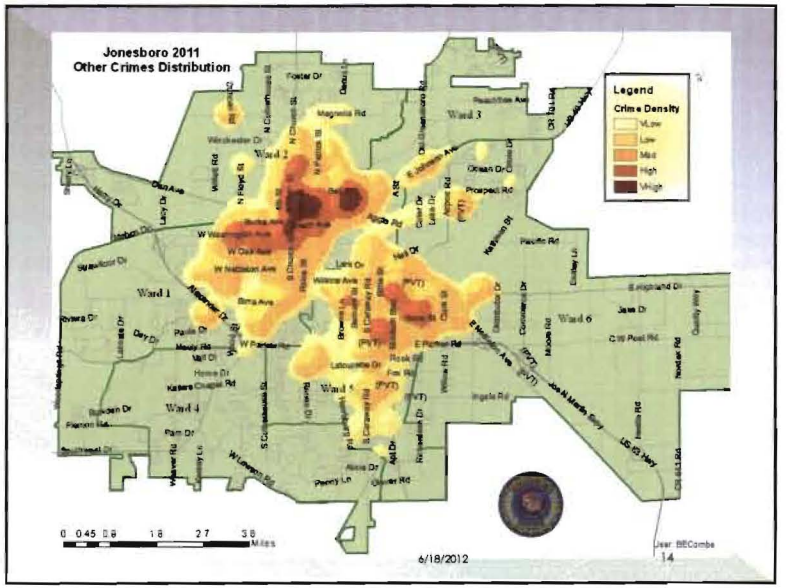






Distribution of Crime

- Observation: persisting hot spots of crime → specific locations
  - Is this distribution random or is there an underlying reason for this distribution?
  - If distribution is not random, what are the drivers of crime in those specific locations?

Crime Distribution: Clustered, Dispersed, or Random?

- Spatial Autocorrelation & Moran's I
  - Given a set of features and an associated attribute, the Spatial Autocorrelation tool evaluates whether the pattern expressed is clustered, dispersed, or random
    - When the z-score or p-value indicates statistical significance, a positive Moran's I index value indicates tendency toward clustering while a negative Moran's I index value indicates tendency toward dispersion

Crime Distribution: Clustered, Dispersed, or Random?

- In order to determine whether there is a significant spatial clustering in all three crime categories and that the clustered pattern was not the result of random chance, the spatial autocorrelation analyses were conducted
  - The results of Moran *I* tests indicate that there is a statistically significant ($p = 0.000$) high to strong positive relationship between each crime categories and their respective distribution
  - There is less than 1% likelihood that the clustering of all three crimes categories in certain areas of Jonesboro is due to a random chance
  - What factors account the most to this clustering of crime?
- View Violent Crimes Moran I full report
- View Property Crimes Moran I full report
- View Other Crimes Moran I full report

Purpose

- The Need: Since the density is not only having an evident history of crime but is also spreading out and there is a strong spatial correlation between crime & place, it is crucial to determine what factors account the most to this distribution.

Causes of Hot Spots

- Repeat places hot spots
  - Underlying causes: Routine activity theory helps to explain why crime often is concentrated at specific places. In particular, routine activity points to how behavior is regulated at the location by place managers—owners of places or people acting on an owner's behalf.
- Repeat victimization hot spots
  - Underlying causes: Repeat crime places with different victims and repeat victimization with different places have different causes. Repeat crime places (with different victims) can be attributable to the behavior of place managers, but if the victimizations occur at different places, place managers have less of a role. In those cases, one should look at the occupations commuting patterns, or lifestyles of the potential victims.
- Repeat streets hot spots
  - Underlying causes: Offenders find targets while going about their normal legitimate business—going to and from work, recreation, shopping, school, and other nodes of activity. Potential targets that are not along the routes or near nodes used by offenders will unlikely be victimized, but those close to offenders' routes and nodes have elevated risks of victimization.
- **Neighborhoods and other area hot spots** *(see following 4 slides for detail explanation)*
  - **Social disorganization** theory - constant residential turnover, poverty
  - **Social efficacy** – Lack of willingness of local residents to intervene for the common good; no mutual trust and solidarity among neighbors
  - **Broken windows** theory – crime is likely to flourish in areas with high levels of physical and social disorder
  - **Crime opportunity** theories – concentration of crime targets (bus staps, shops, fast food, other businesses etc)

Neighborhoods and other area hot spots

- **SOCIAL DISORGANIZATION THEORY**
  - This theory suggests that the natural ability of people to control deviancy in their neighborhoods is impaired in some areas by constant residential turnover and net outmigration.
  - These changes either disrupt social networks or prevent such networks from forming.
  - Since these networks, are responsible for most social control in neighborhoods, their absence leads to higher levels of deviancy.
  - Poverty, also have been identified as undermining social networks.

Neighborhoods and other area hot spots

SOCIAL EFFICACY

- Recent evidence from Chicago points to the role of social efficacy, which is "the willingness of local residents to intervene for the common good." It depends on "mutual trust and solidarity among neighbors" (Sampson, Raudenbush, and Earls, 1997, page 919)
- Neighborhoods that have a great deal of social efficacy have less crime and disorder than neighborhoods that have low levels.
- Social efficacy—like disorganization and social networks—is not a property of individual people or places, but a characteristic of groups of people.

Neighborhoods and other area hot spots

BROKEN WINDOWS THEORY

- The broken windows theory also is an area theory of crime concentration.
- Wilson and Kelling (1982) claim that in most well-functioning neighborhoods, small transgressions of social norms (e.g., failure to keep one's yard tidy) result in social pressures to bring the offending party into compliance.
- Once a place becomes untended, however, it undermines the willingness and ability of residents to enforce social order.
- Consequently, residents withdraw from enforcing neighborhood norms, which allows further deviancy to occur.
- This in turn results in additional withdrawal and fear and the neighborhood begins to spiral downward.

Neighborhoods and other area hot spots

CRIME OPPORTUNITY THEORIES

- Another explanation for neighborhood-level hot spots comes from routine activity theory and related theories that point to crime opportunities as the principle cause of crime.
- Rather than concentrations of offenders or the absence of social controls, opportunity theories suggest that analysts should look for concentrations of crime targets.
  - For example, a dense urban neighborhood with no off-street parking will have many cars parked on the street. Such an area may become an area hot spot for thefts from vehicles.
  - A suburban subdivision inhabited by dual-income families will have few people at home during weekdays. Since their property is unprotected, their neighborhood can become an area burglary hot spot. Note that in this type of situation, several layers of hot spots can exist simultaneously. Within area hot spots, defined by the subdivision in this example, might be streets with even greater numbers of burglaries, and some of the homes on these streets may be broken into multiple times.

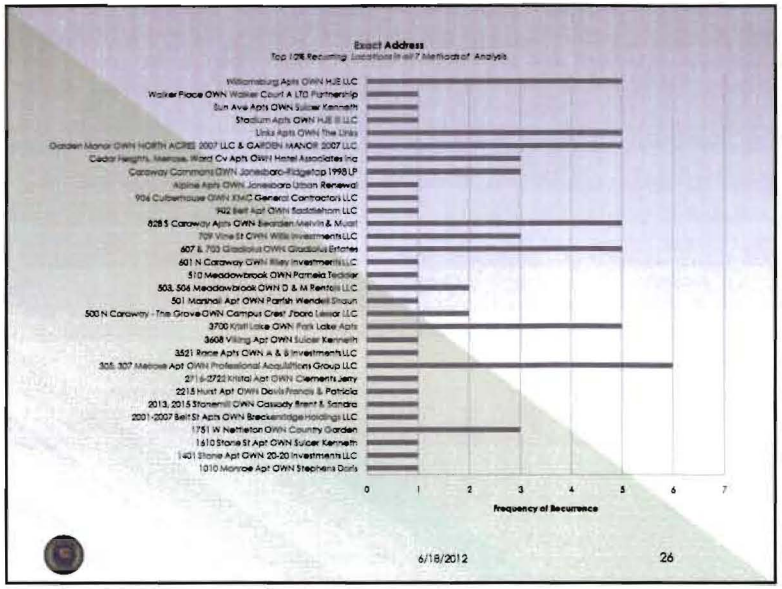
Contributing Factors

Deduced from Neighborhood Hot Spots Theories

- Rental Properties
- Population Density
- Vacant Housing
- Probationers/Parolees
- Household Income
- Education
- Targets of Crime

Crime Distribution in Relation to Rental Properties

- Some rental properties were observed to have a higher concentration of crime than others, apartments specifically
- Study 1: all apartment complexes in Jonesboro by ownership and their spatial relationship to crime (*Combs, 2011*)
  - 7 methods of analysis
  - Locations with highest crime concentration identified



Crime Distribution in Relation to Rental Properties

- Some of the top 10% of rental properties with highest crime were recognized as Jonesboro Urban Renewal & Housing Authority's (JURHA) and Section 8, specifically
- Study 2: separates Section 8 locations, JURHA locations, and top 10% rental locations with highest crime from within rental properties

Methodology Variables (data available)

Independent Variables (contributing factors)

- Rental Properties
  - Top 10% of Rental Properties with Highest Crime
  - Section 8
  - JURHA
- Population
- Vacant Units
- Probationers/Parolees
- Household Income

Dependent Variables(outcome)

- Violent Crime
- Property Crime
- Other Crime

Methodology Analysis

Correlation (Pearson's)

- The Pearson R correlation tells us the magnitude and direction of the association between two variables
- Range -1 to +1, where:
  - 0 = no association
  - The closer the correlation to +1 or -1, the stronger the correlation
  - "+"or positive correlation = as one increases so is the other
  - "-"or negative = as one increases, the other decreases

Multiple Regression

- A statistical method used to examine the relationship between a variable of interest (dependent variable) and **one or more** explanatory variables (predictors)
- Focus on the following factors:
  - Strength of the relationship
  - Direction of the relationship (positive, negative, zero)
  - Goodness of model fit
- Allows to calculate the amount by which the dependent variable changes when a predictor variable changes by one unit (holding all other predictors constant)
- Just like correlation, if an explanatory variable is a significant predictor of the dependent variable, it doesn't imply that the explanatory variable is a *cause* of the dependent variable, but rather that it accounts to the specific distribution

Correlation

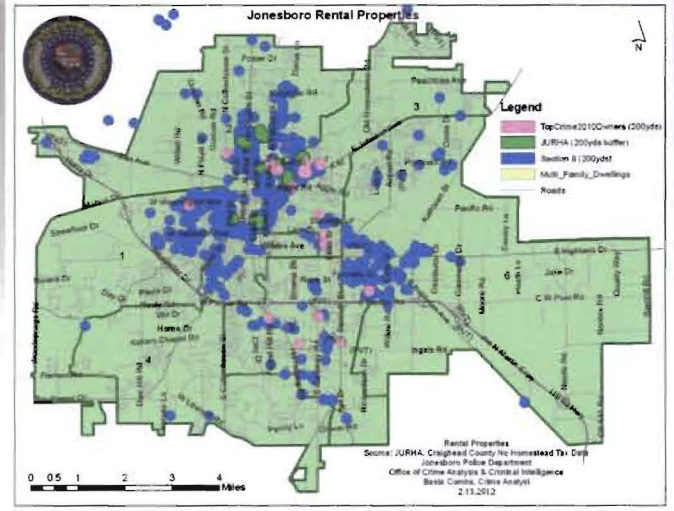
Results

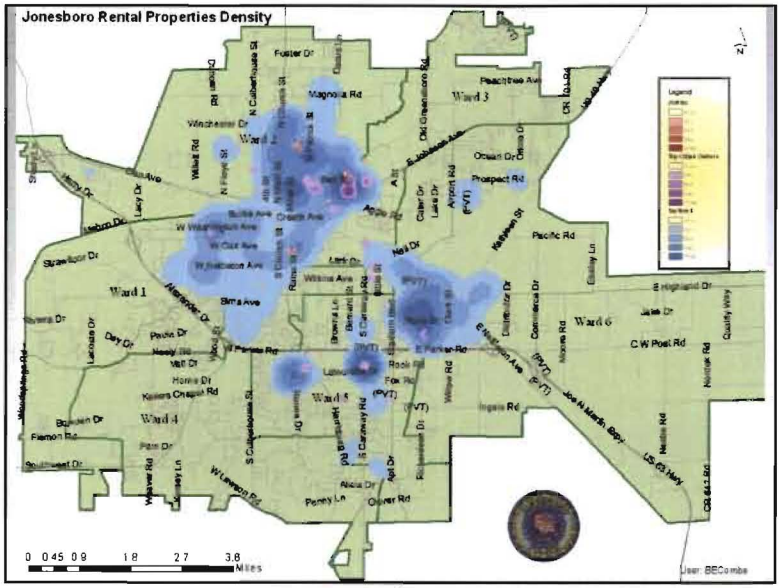
Accepted and Rejected Variables

	Rent - Top 10% Crime	JURHA	Section 8	Vacant	Probation /Parole	Population	Median Income
Violent Crime	r =.13 sig = .000	r =.32 sig = .000	r =.54 sig = .000	r =.46 sig = .000	r =.30 sig = .000	r =.46 sig = .000	r = -.13 sig = .000
Property Crime	r =.14 sig = .000	r =.18 sig = .000	r =.34 sig = .000	r =.35 sig = .000	r =.18 sig = .000	r =.38 sig = .000	r = -.11 sig = .000
Other Crime	r =.26 sig = .000	r =.32 sig = .000	r =.48 sig = .000	r =.49 sig = .000	r =.32 sig = .000	r =.44 sig = .000	r = -.21 sig = .000

- Accepted (based on violent crime)
  - Section 8 = strong positive relationship
  - Population = strong positive relationship
  - Vacant = strong positive relationship
  - JURHA = moderate positive relationship
  - Probation/Parole = moderate positive relationship
- Rejected (based on violent crime)
  - Top 10% of Rental Properties w/highest crime = negligible relationship
  - Median Income = negligible relationship

Spatial Relationship




Jonesboro Rental Properties Density
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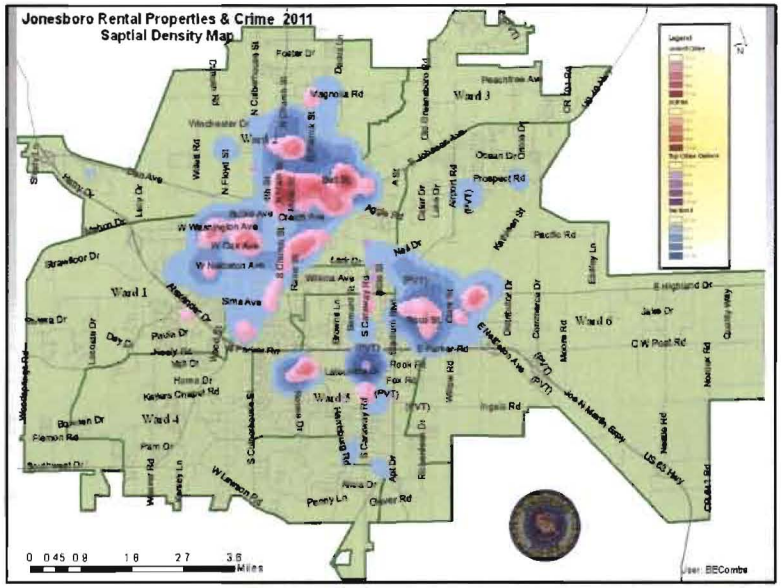
Jonesboro Rental Properties & Crime 2011
Saptial Density Map
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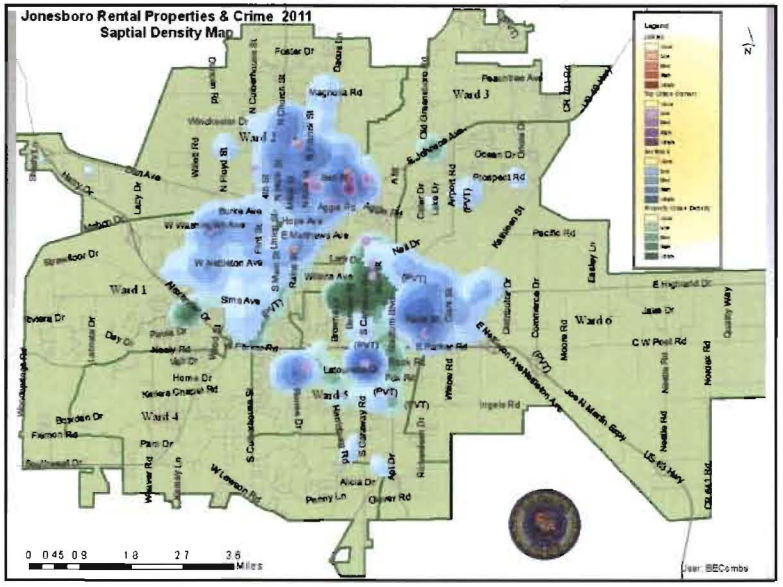
Jonesboro Rental Properties & Crime 2011
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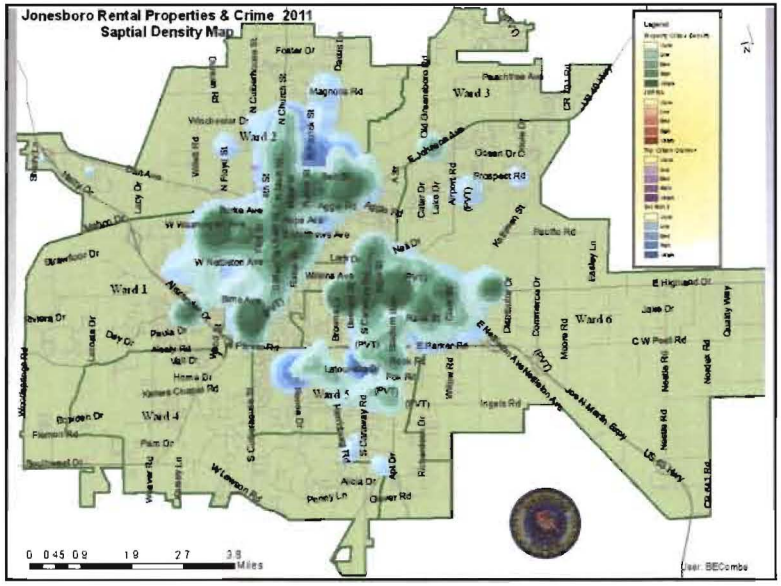
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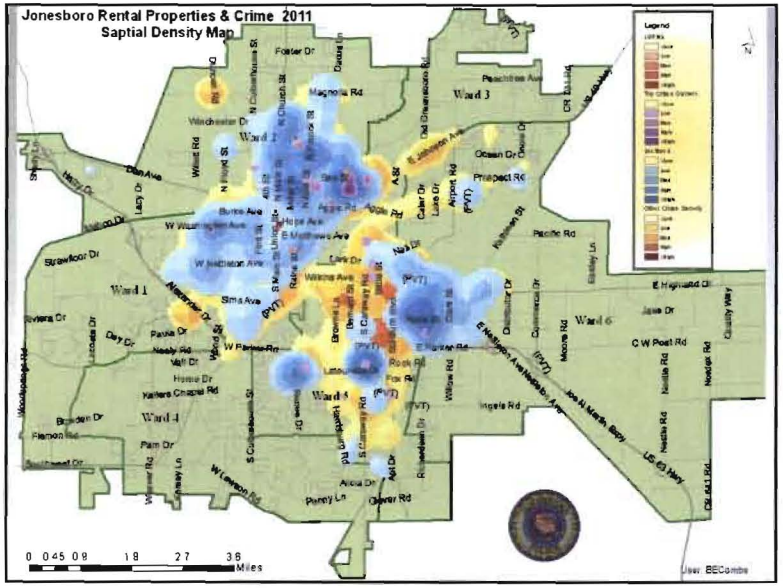
Jonesboro Rental Properties & Crime 2011
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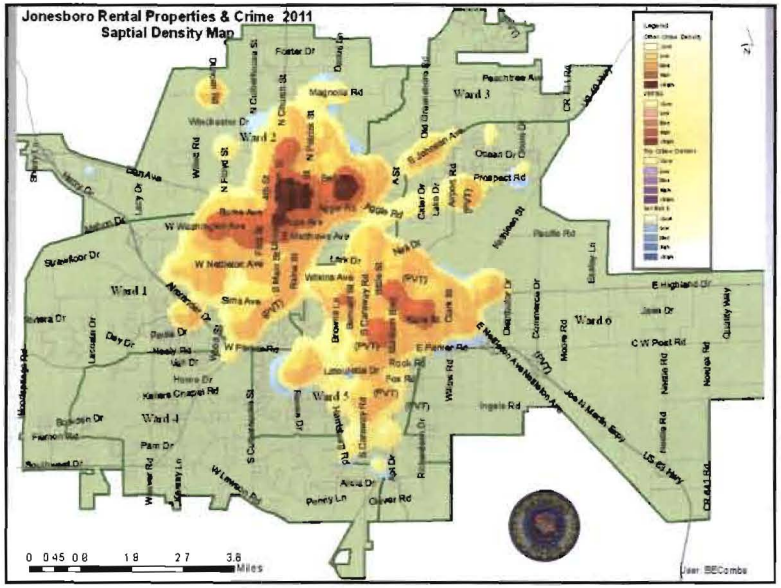
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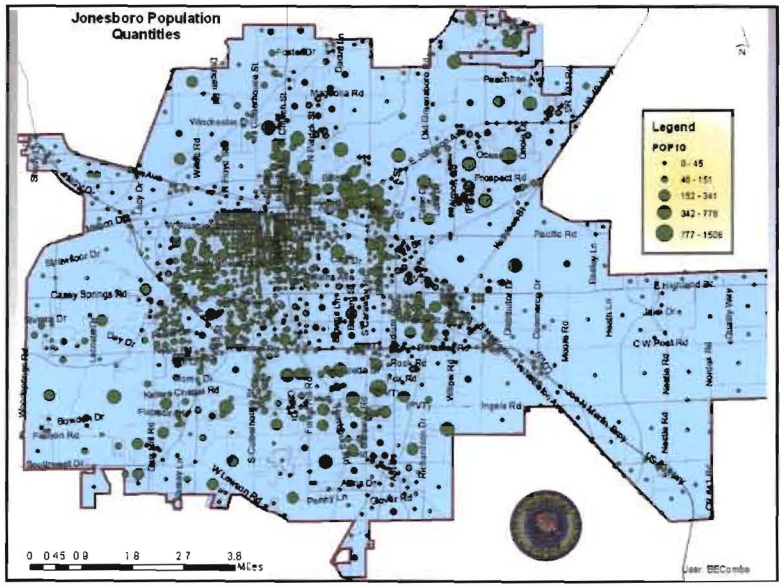
Jonesboro Population
Quantities
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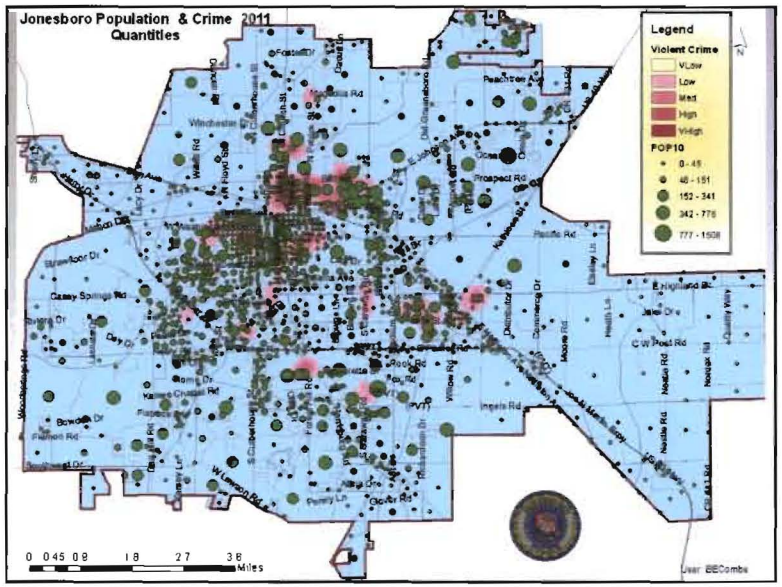
Jonesboro Population & Crime 2011
Quantities
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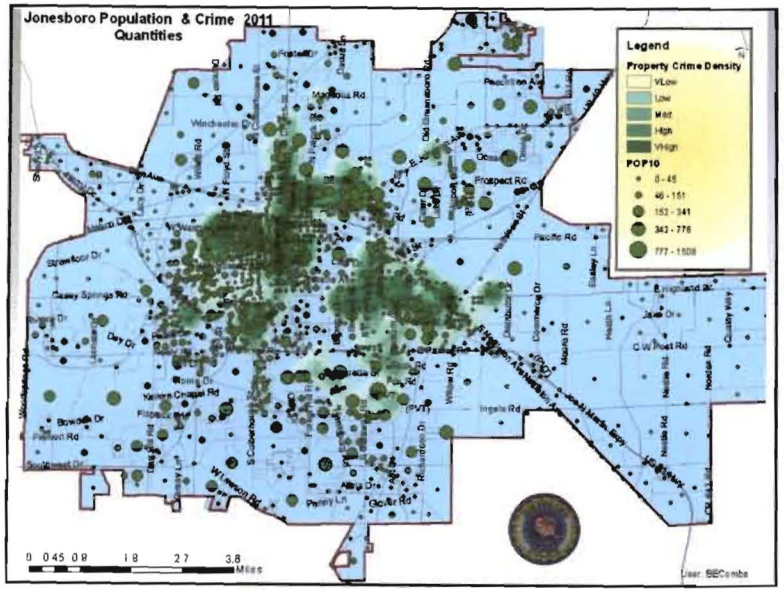
Jonesboro Population & Crime 2011
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Property Crime Density
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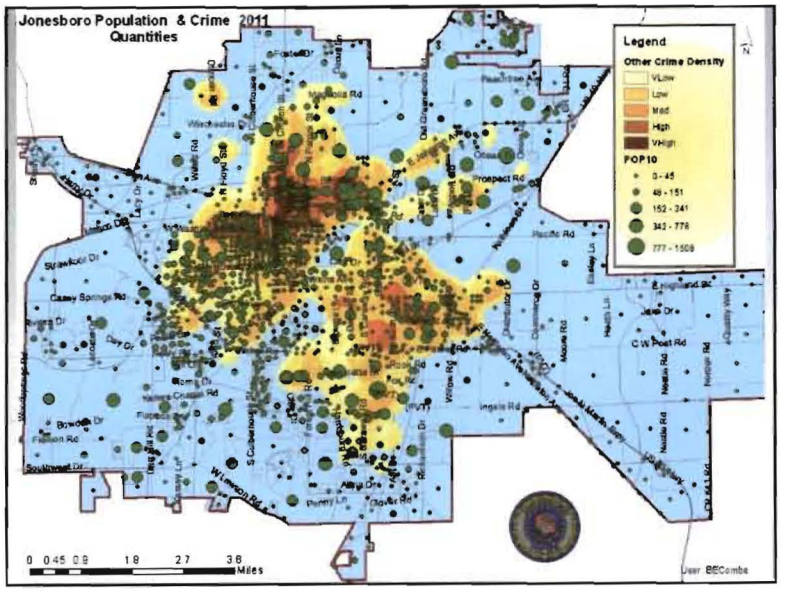
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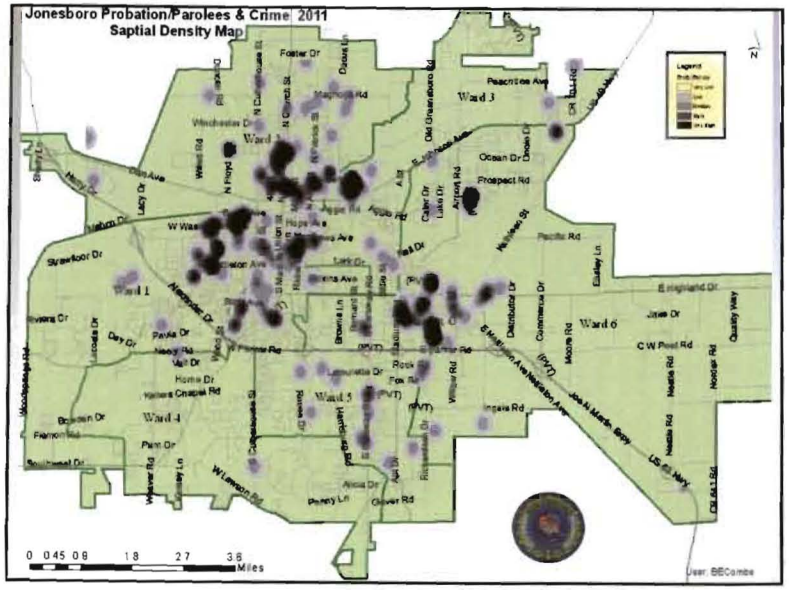
Jonesboro Probation/Parolees & Crime 2011
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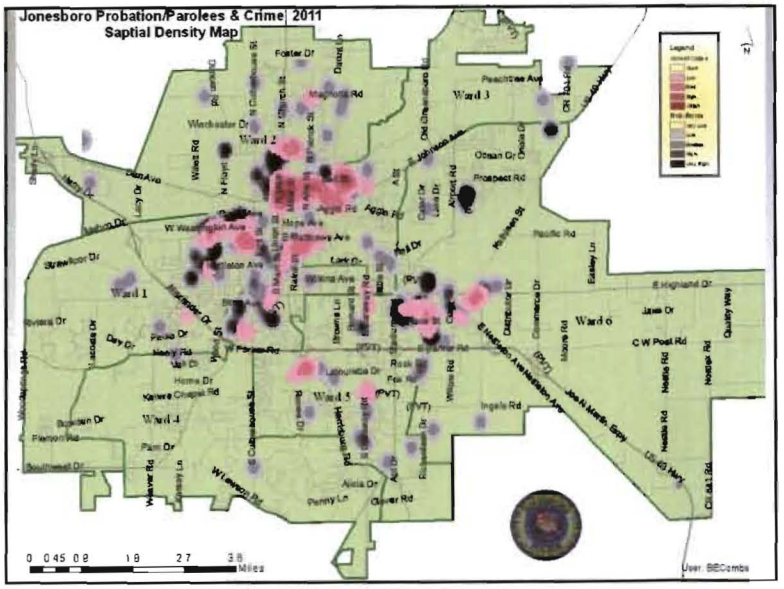
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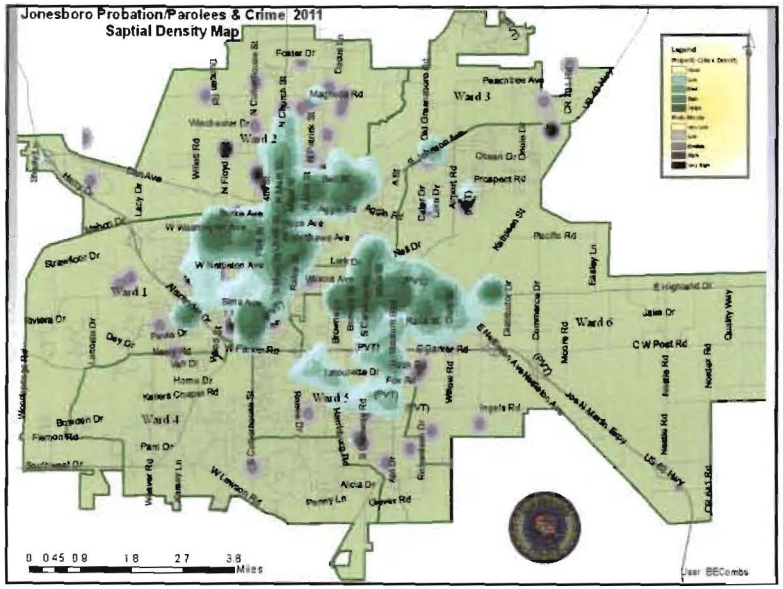
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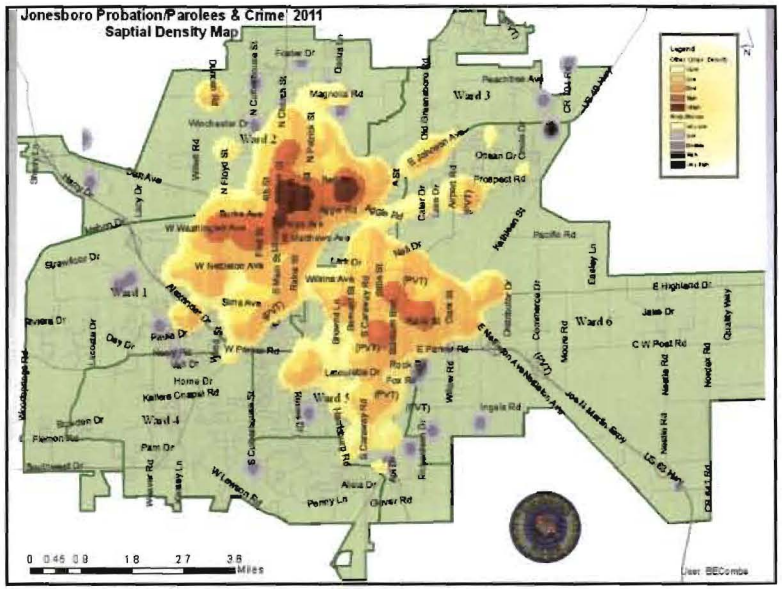
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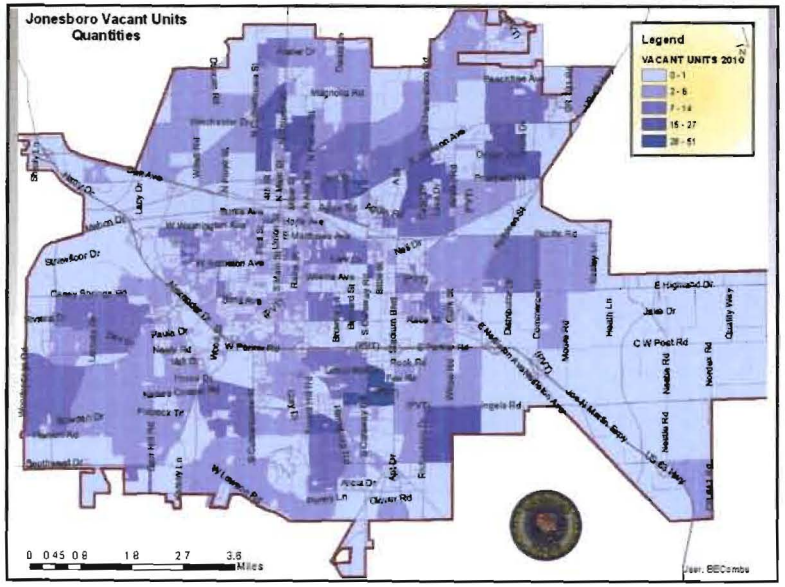
Jonesboro Vacant Units
Quantities
Legend
VACANT UNITS 2010
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2 - 6
7 - 14
15 - 27
28 - 51
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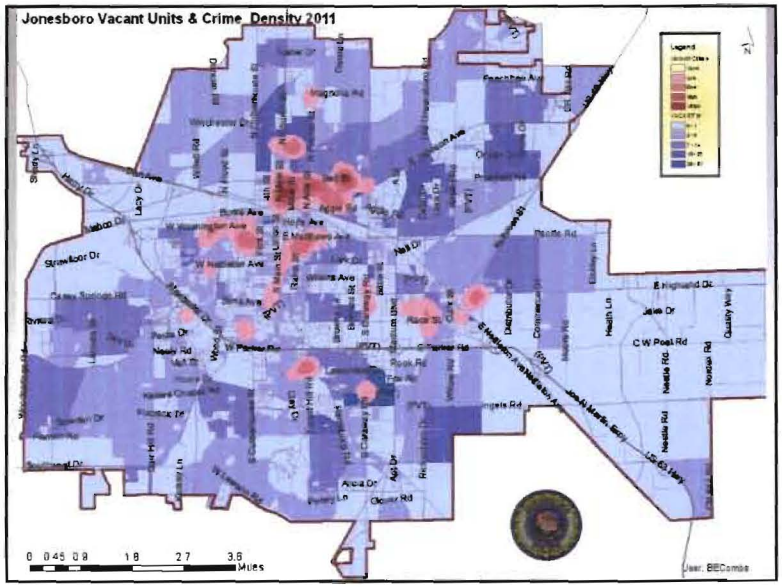
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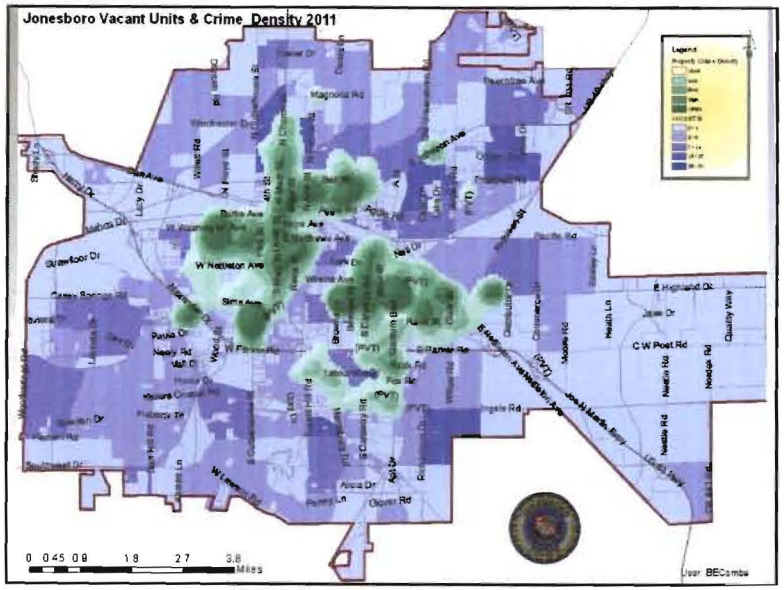
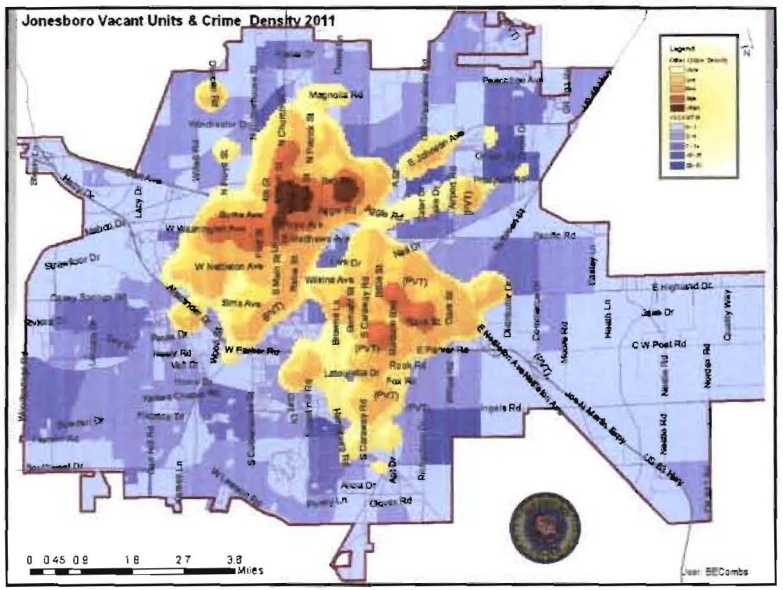




Multiple Regression Results:
Dependent Variable = Violent Crime

- R Square = .37
- Sig. = .000

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.044	.015		2.914	.004
	Sec8	.054	.005	.282	10.818	.000
	JURHA	.056	.007	.165	7.914	.000
	ProbParole	.146	.036	.069	4.057	.000
	pop10	.001	.000	.149	5.574	.000
	vacant10	.028	.005	.150	5.565	.000

a. Dependent Variable: ViolentCrt

Analysis: Violent Crime

- 37% of violent crime variation is explained by this set of variables
- Section 8 has the strongest effect on violent crime, following by JURHA, Vacant Units, Population, and Probationers/Parolees
- For every unit increase in a respectful variable, we can predict the following change in crime

Independent Variable	Violent Crime Increase per Unit	Violent Crime Increase per 10 Units
Sec8	0.1	0.6
JURHA	0.1	0.6
ProbParole	0.2	1.5
pop10	0.1	0.2
vacant10	0.0	0.3

Multiple Regression Results: Dependent Variable = Property Crime

- R Square = .184
- Sig. = .000

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.581	.118		4.929	.000
	Sec8	.157	.040	.118	3.921	.000
	JURHA	.183	.057	.079	3.188	.001
	ProbParole	.232	.281	.020	.823	.410
	pop10	.011	.002	.211	6.977	.000
	vacant10	.172	.040	.122	4.345	.000

a. Dependent Variable: PropertyCrimes

Analysis: Property Crime

- Over 18% of property crime variation is explained by this set of variables
- Population has the strongest effect on property crime, following by Vacant Units, Section 8, and JURHA
- Probation/Parole not statistically significant
- For every unit increase in a respectful variable, we can predict the following change in crime

Independent Variable	Property Crime per Unit Increase	Property Crime per every 10 Units Increase
Sec8	0.7	2.1
JURHA	0.3	2.0
pop10	0.2	0.3
vacant10	0.2	1.7

Multiple Regression Results: Dependent Variable = Other Crime

- R Square = .36
- Sig. = .000

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.530	.199		7.695	.000
	Sec8	.410	.067	.183	6.058	.000
	JURHA	.892	.097	.183	9.193	.000
	ProbParole	2.625	.475	.130	5.950	.000
	pop10	.013	.003	.124	4.629	.000
	vacant10	.604	.067	.244	9.023	.000

a. Dependent Variable: OtherCrimes

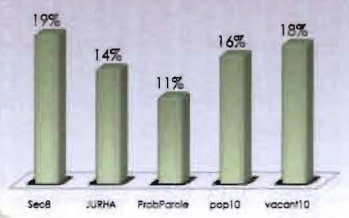
Analysis: Other Crime

- 36% of other crime variation is explained by this set of variables
- Vacant Units have the strongest effect on other crime, following by JURHA, Section 8, Probationers/Parolees, and Population
- For every unit increase in a respectful variable, we can predict the following change in crime

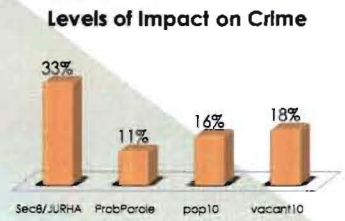
Independent Variable	Other Crime per Unit Increase	Other Crime per every 10 Units Increase
Sec8	1	6
JURHA	0	4
ProbParole	3	25
pop10	0	0
vacant10	0	0

Summary

It is evident that from all the contributing factors in the model, based on averaged Unstandarized Coefficient Beta, Section 8 has the greatest impact on all the combined crime categories, following by Vacant Units, Population Density, JURHA, and Probation/Parolees



- As the Section 8 and JURHA are administered by the same entity, combining these two variables into one helps us even better depict this distribution



Summary

- There could be many reasons causing such impact. Examples are:
  - Poverty
  - Social disorganization
  - Persisting unemployment
  - Organizational policies and procedures
- To find out whether our variables are actually causing crime in our city, we would have to design another study that would include the set of variables proven to cause the crime and control for them in the new model

Recommendations to the Administration of the City of Jonesboro

Address social ills related to criminal activities

Containment (prevent the expansion of crime)

Reduce Poverty Levels	Enhance Education	Reduce Unemployment	Address Alcohol and Drug Dependency	**Social disorganization** reduce constant residential turnover & poverty	**Social efficacy** – improve the willingness of local residents to intervene for the common good; create programs that would increase mutual trust and solidarity among neighbors	**Broken windows** reduce levels of physical and social disorder	**Crime opportunity** reduce concentration of crime targets (bus stops, shops, fast food, other businesses etc)

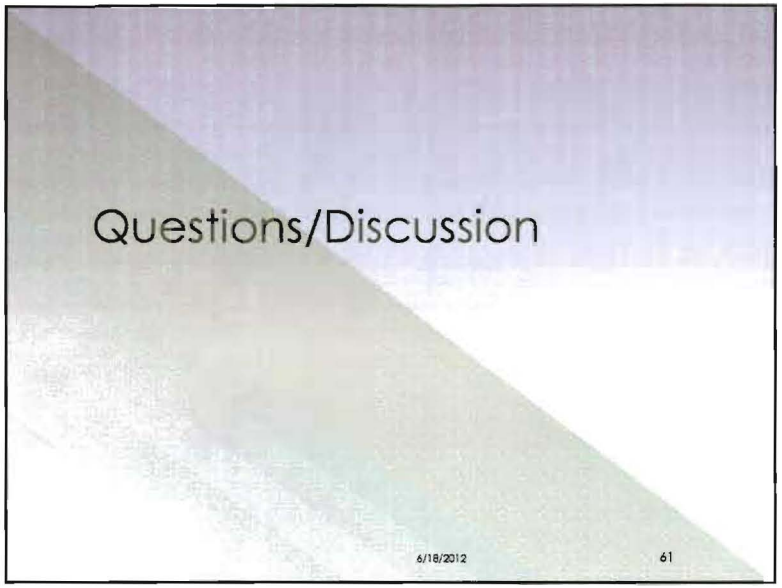
Recommendations to the Police Department

Disorder
- Social Disorder
  - Increased misdemeanor arrests, focusing on enforcement of public order violations such as Public Drinking, Drug Dealing, and Loitering
  - Increased foot and bicycle patrol

Programs
- Housing Study Committee
- Develop and implement the Crime Hot Spot Reduction & Prevention Program

Services
- Offer background checks
- Continue education on drug and alcohol resistance
- Request changes in JURHA management policies

Prevention
- Apply Risk Terrain Modeling to identify other potential hot spots


Questions/Discussion
6/18/2012
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