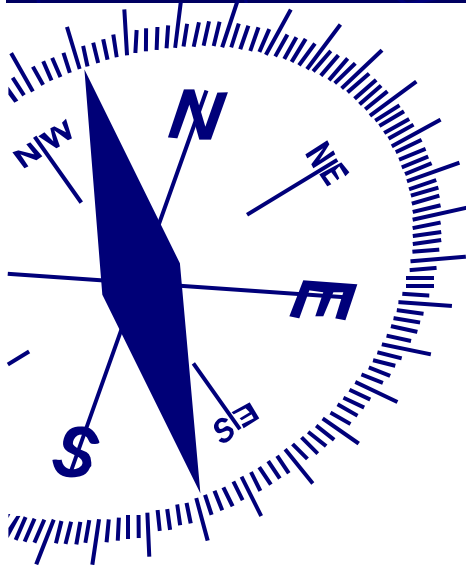


Risk Terrains: Theoretically- and Empirically-Grounded Spatial Models for Tactical Decision-Making

Presented at the
ESRI International User Conference

July 2010 | San Diego, CA



Leslie W. Kennedy
kennedy@newark.rutgers.edu

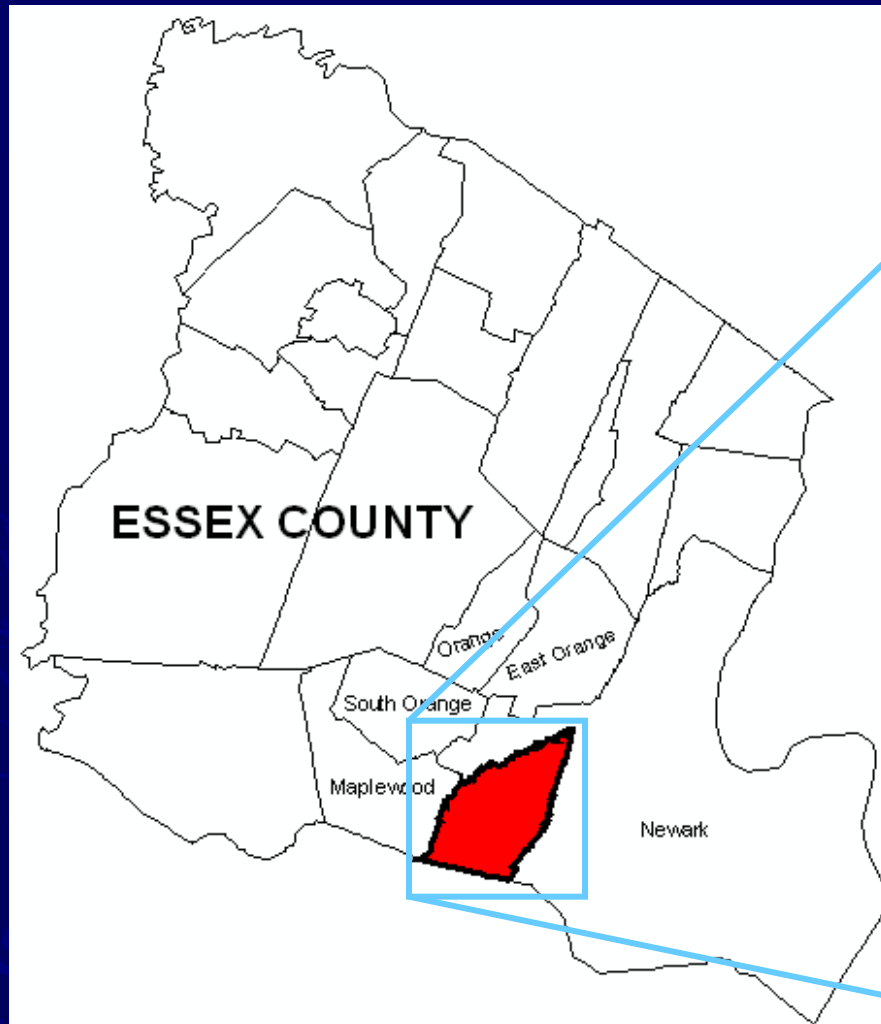
Joel M. Caplan
jcaplan@newark.rutgers.edu

Center for Law & Justice
123 Washington Street
Newark, NJ 07102

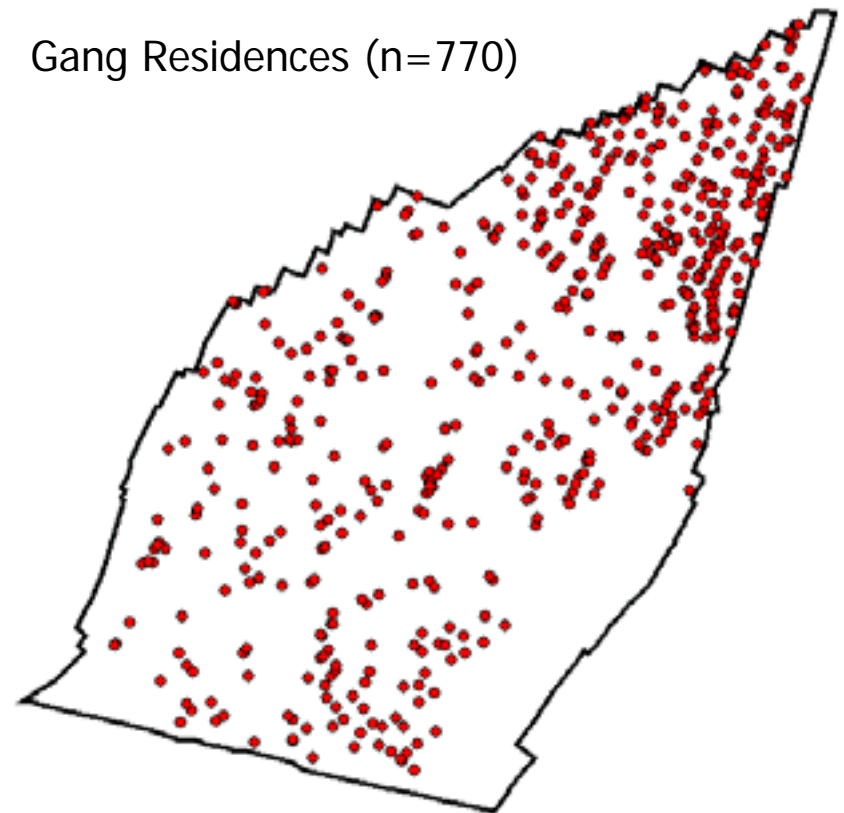
www.rutgerscps.org



IRVINGTON, NJ

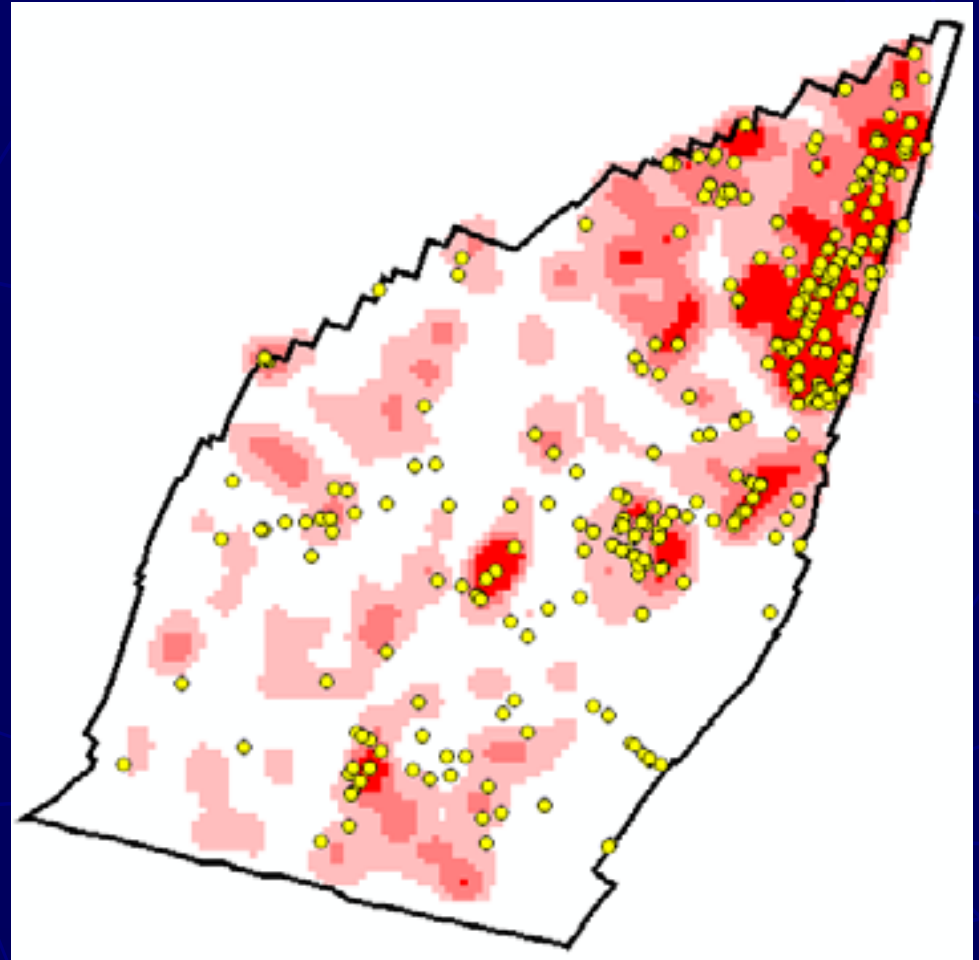


Gang Residences (n=770)



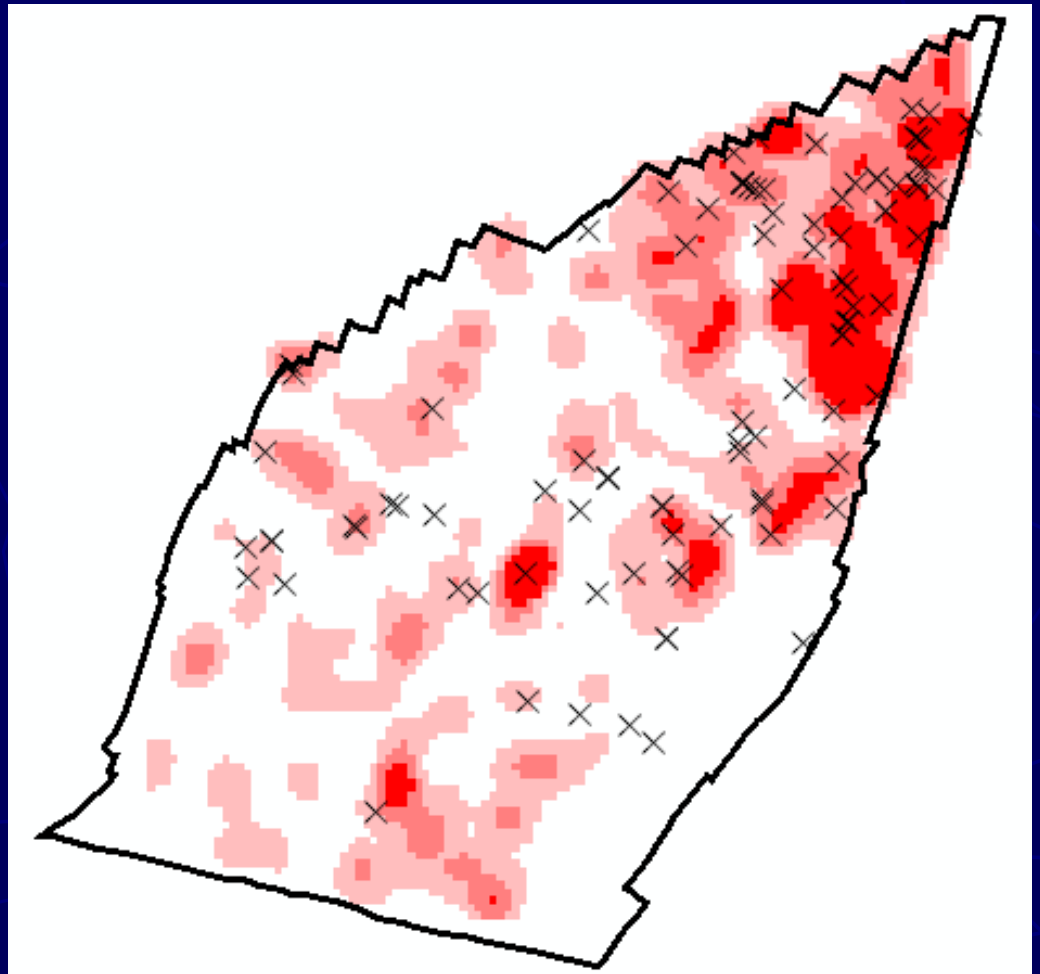
Drug Arrests (points) Gang Residences (density)

- ▶ Drug arrests cluster in areas where large numbers of gang members live.



Shootings (x) Gang Residences (density)

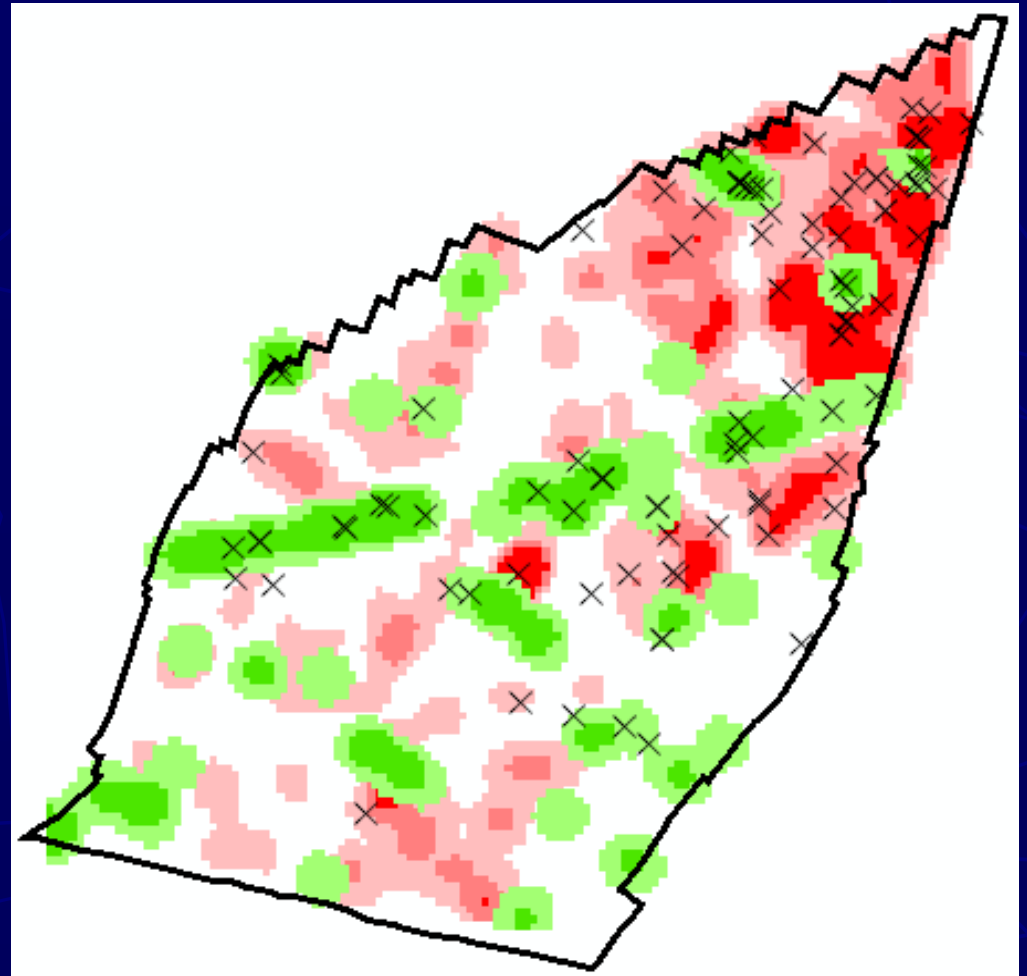
- ▶ Shootings occur most often in areas where drugs are sold and many gang members live.



Shootings (x)

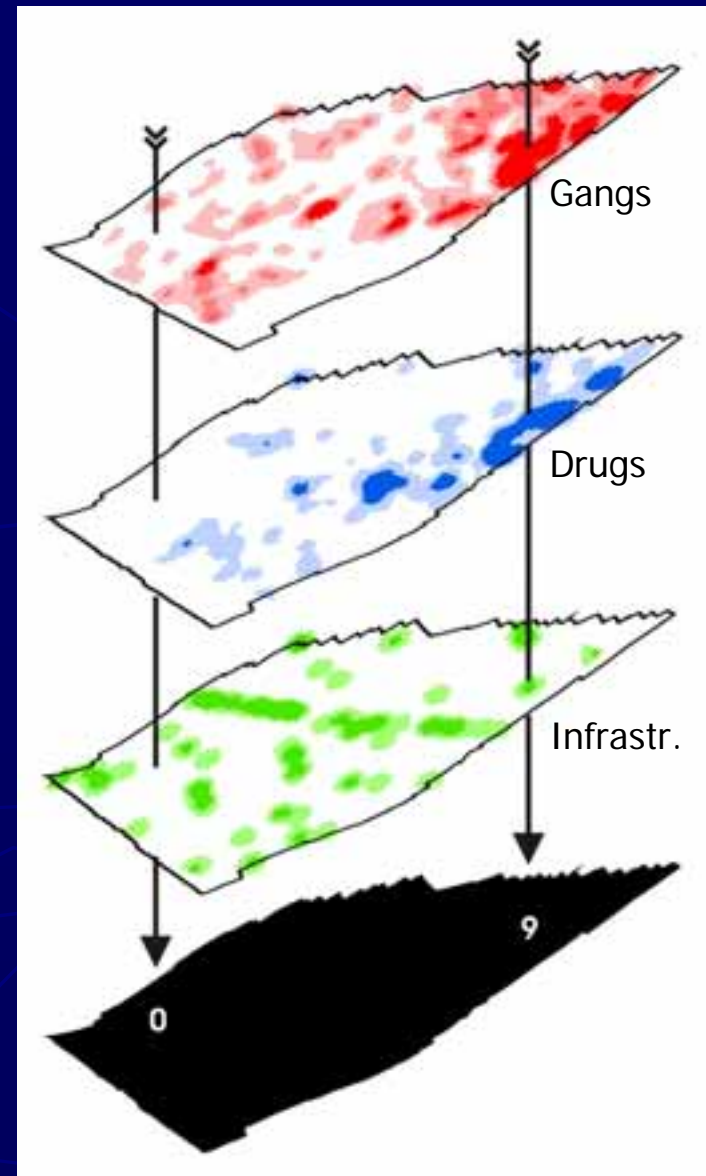
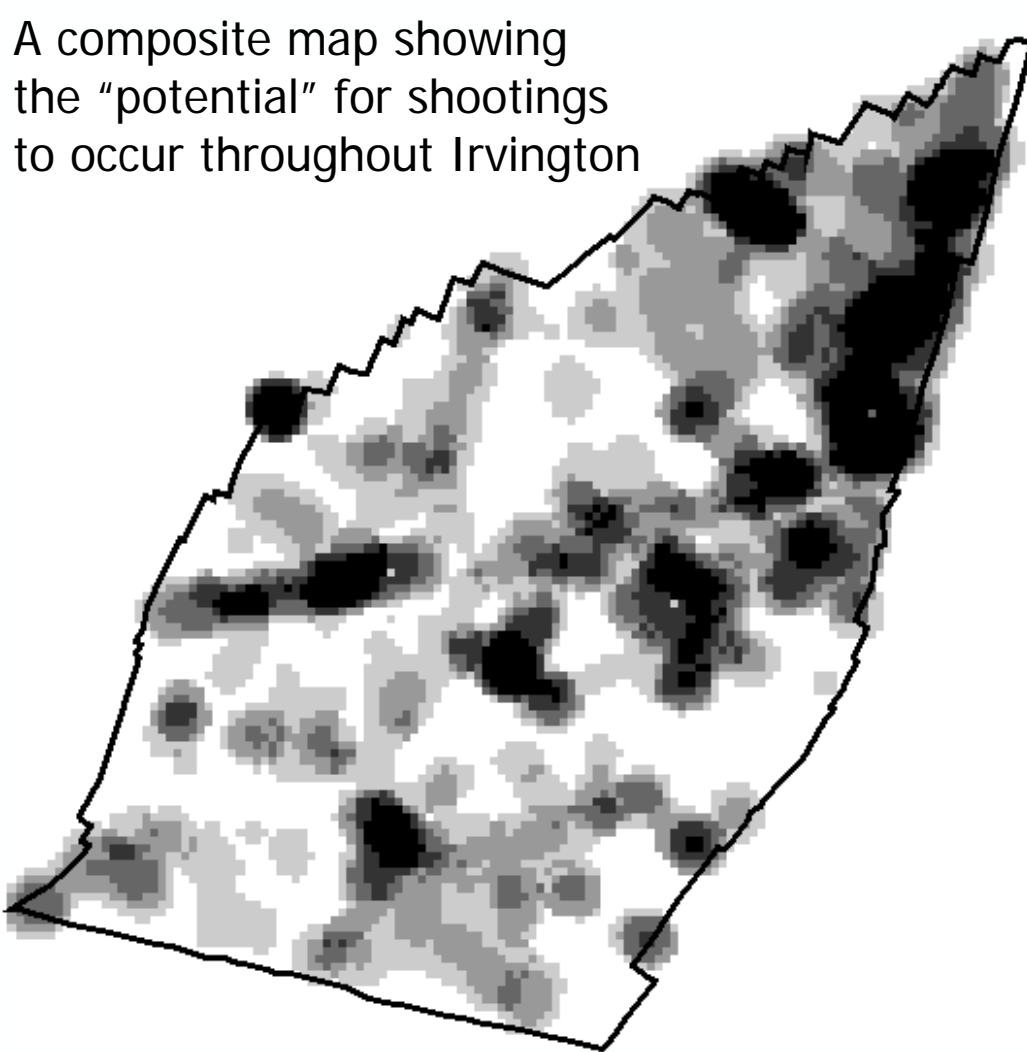
Gang & Infrastructure (density)

- ▶ Liquor stores, bars, strip clubs & fast food restaurants help to explain shootings outside of gang or drug areas.

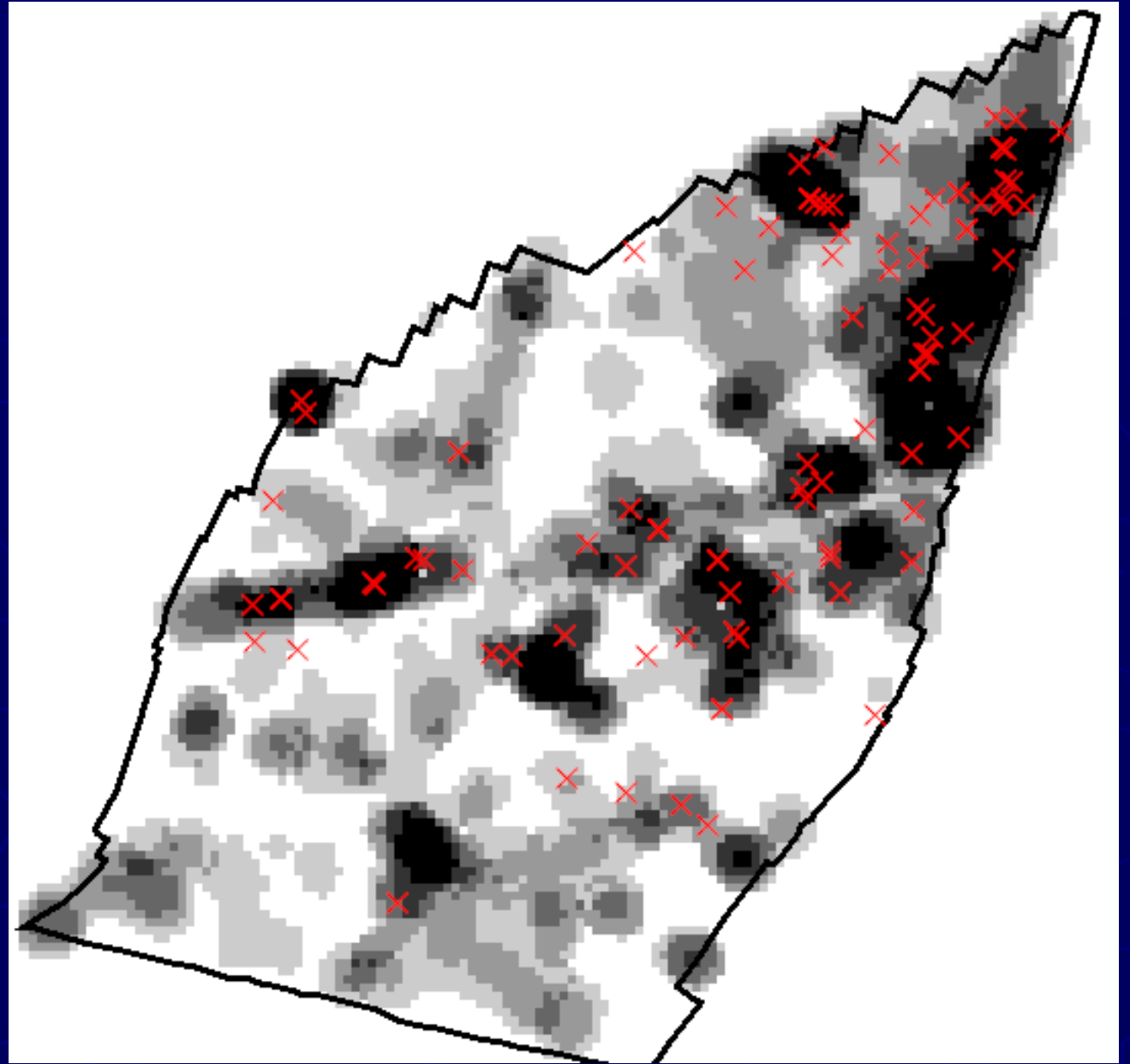


RISK TERRAIN

A composite map showing the "potential" for shootings to occur throughout Irvington

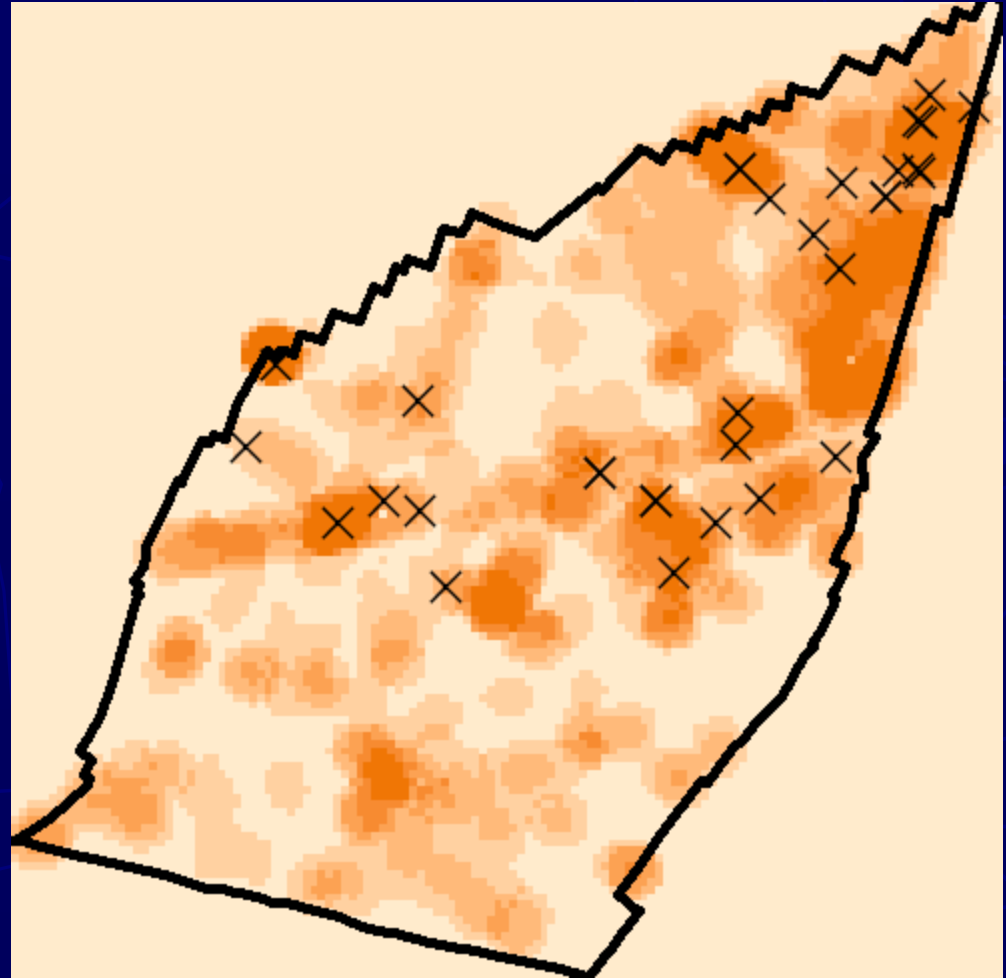


Risk Terrain
matches
locations of
actual
shootings.



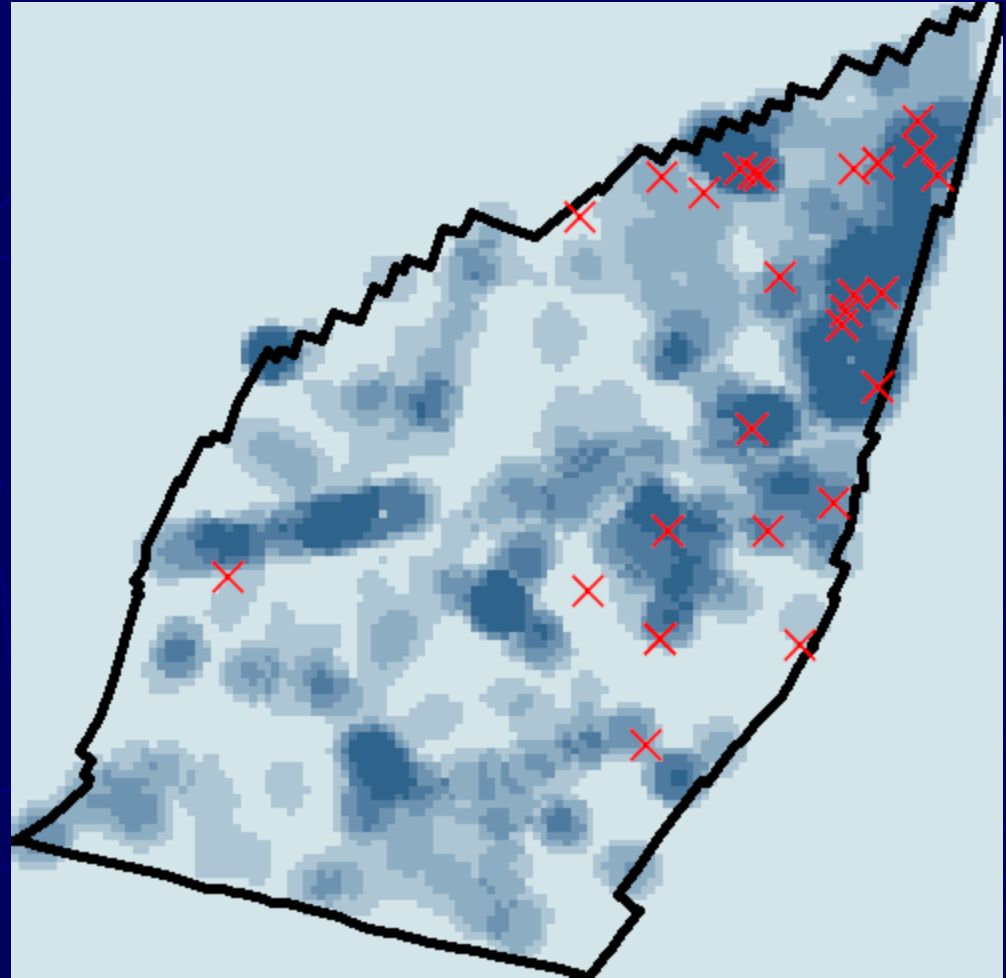
Shootings (x) Risk Terrain

► Jan. 2007 – June 2007



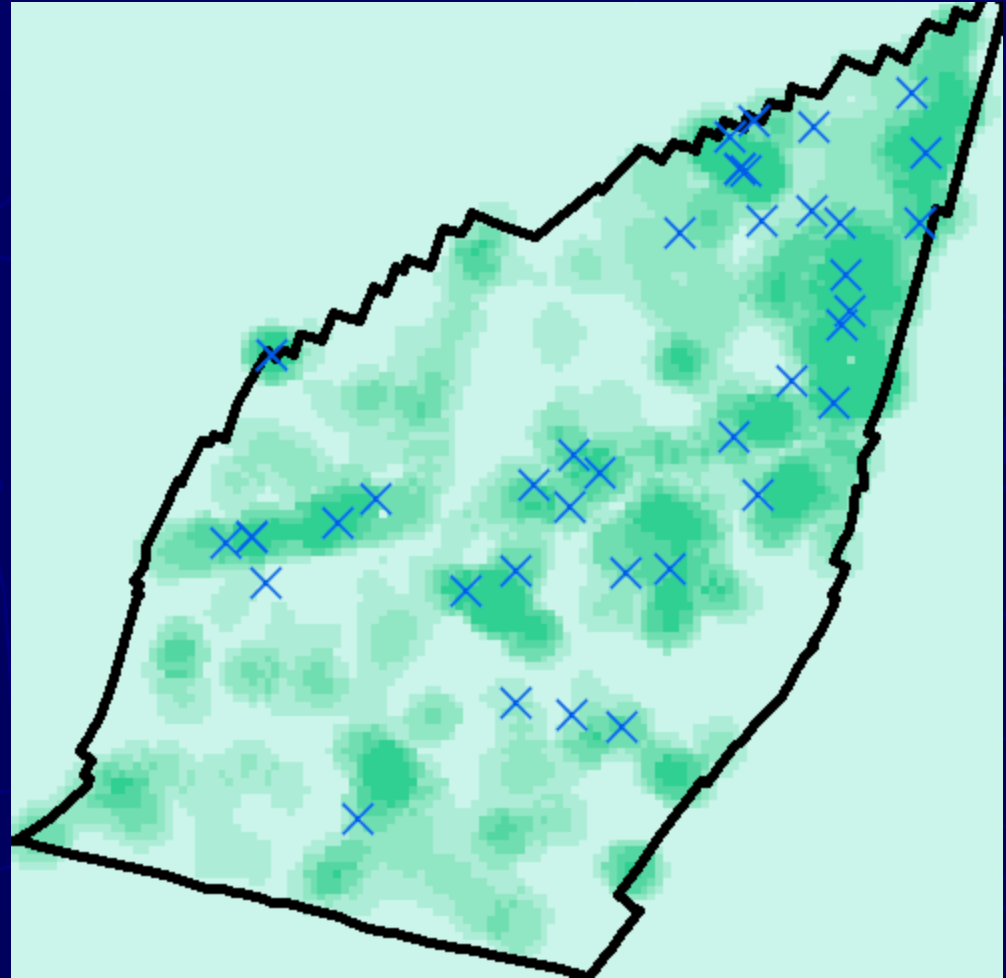
Shootings (x) Risk Terrain

► July 2007 – Dec. 2007



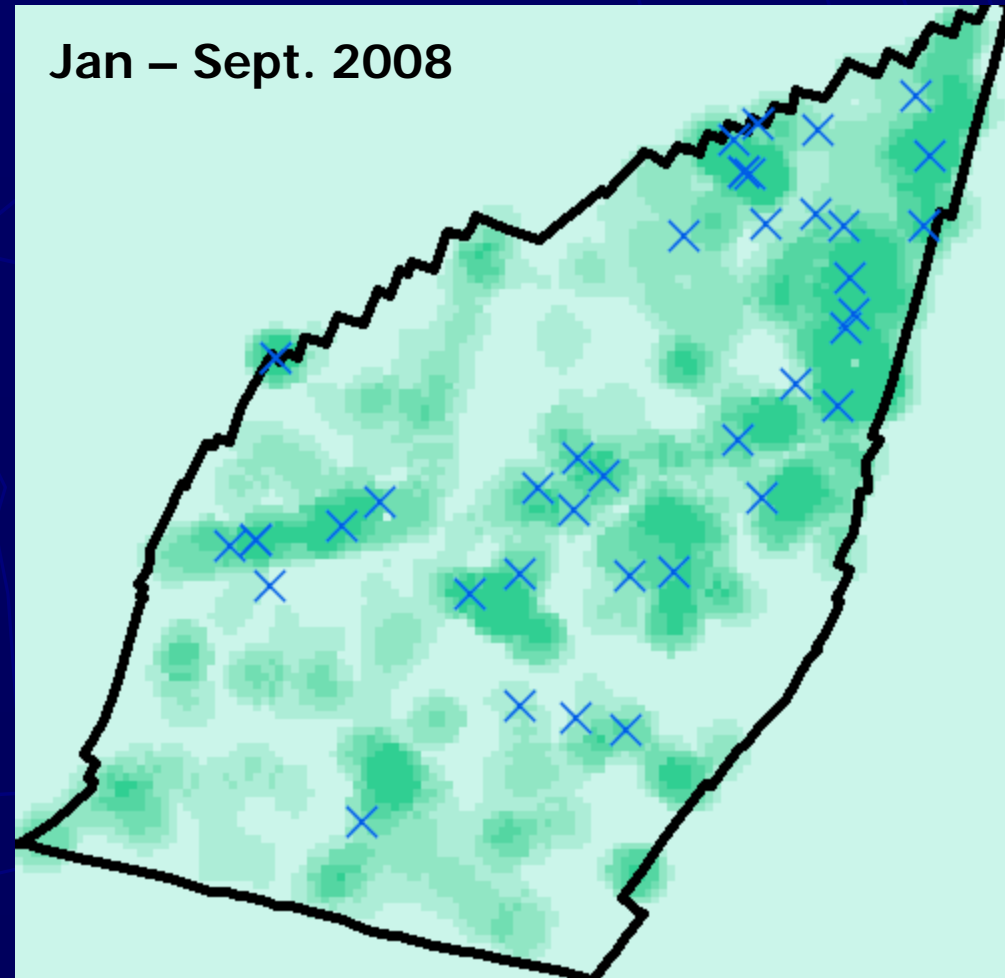
Shootings (x) Risk Terrain

► Jan. 2008 – Sept. 2008

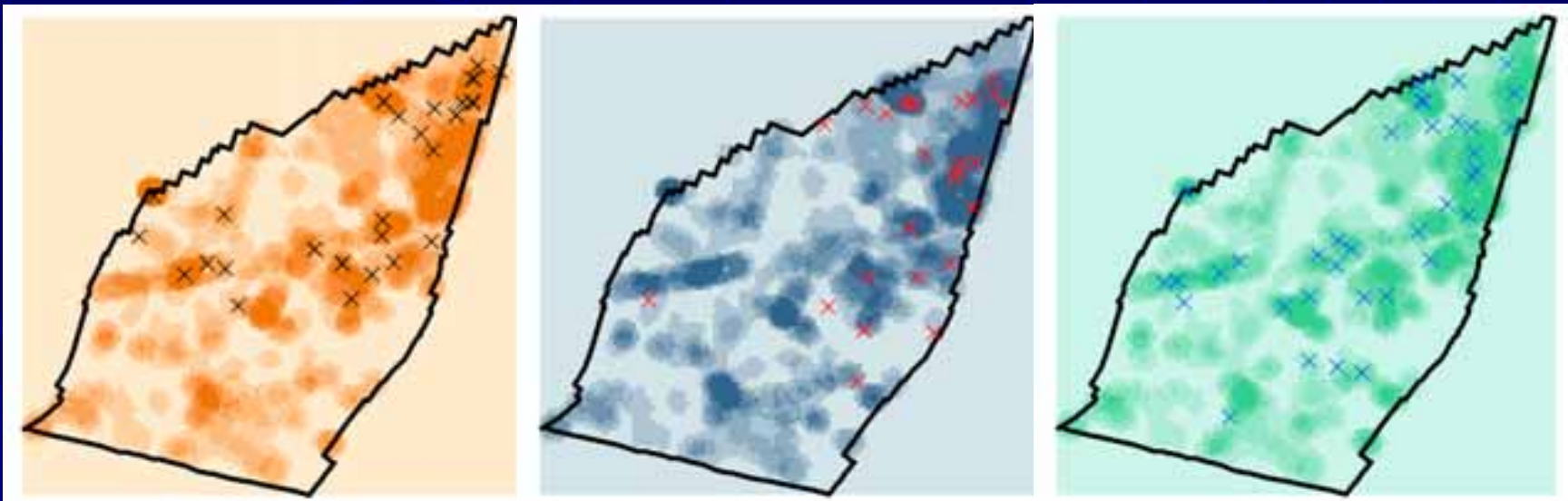


21 Month Animation

- ▶ Watch shooting incidents disperse South, and then to the West



But is it statistically significant?



Jan-June 2007

July-Dec 2007

Jan-Sept 2008

Risk Map Layer Classification Method

Figure 1: Example of risk value determination from Standard Deviation classification schema

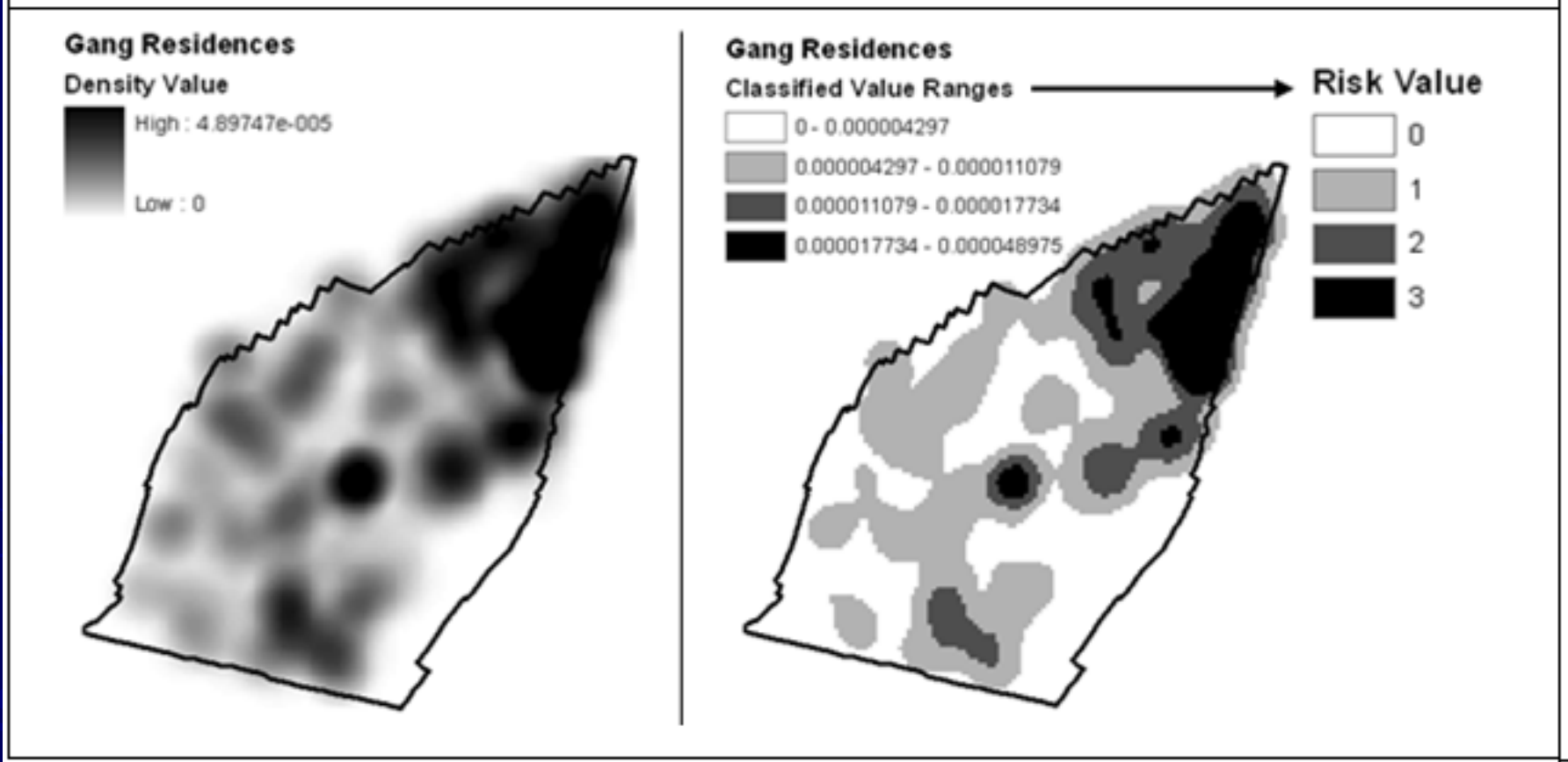


Figure 2: Risk Terrain and Shooting Overlay

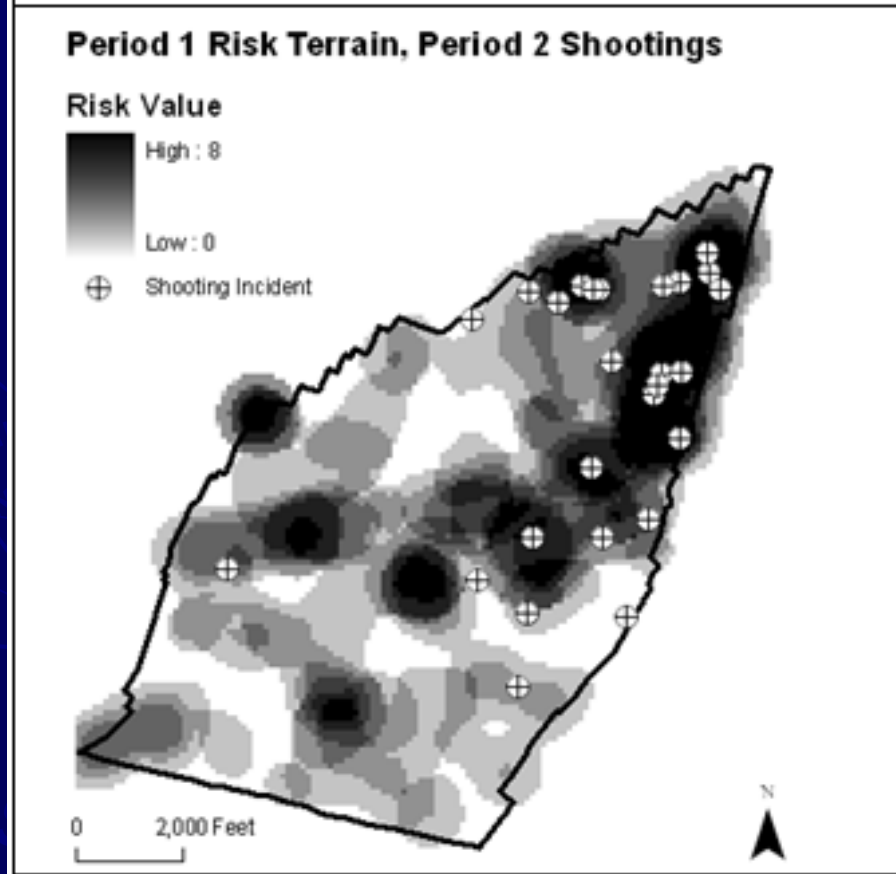
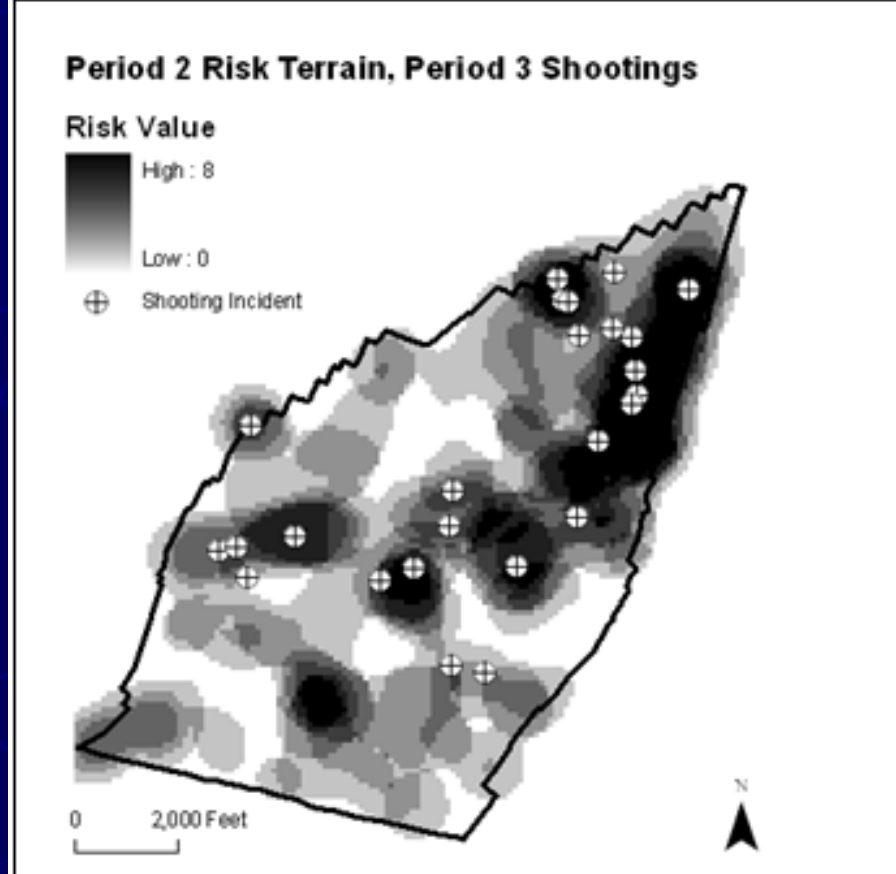
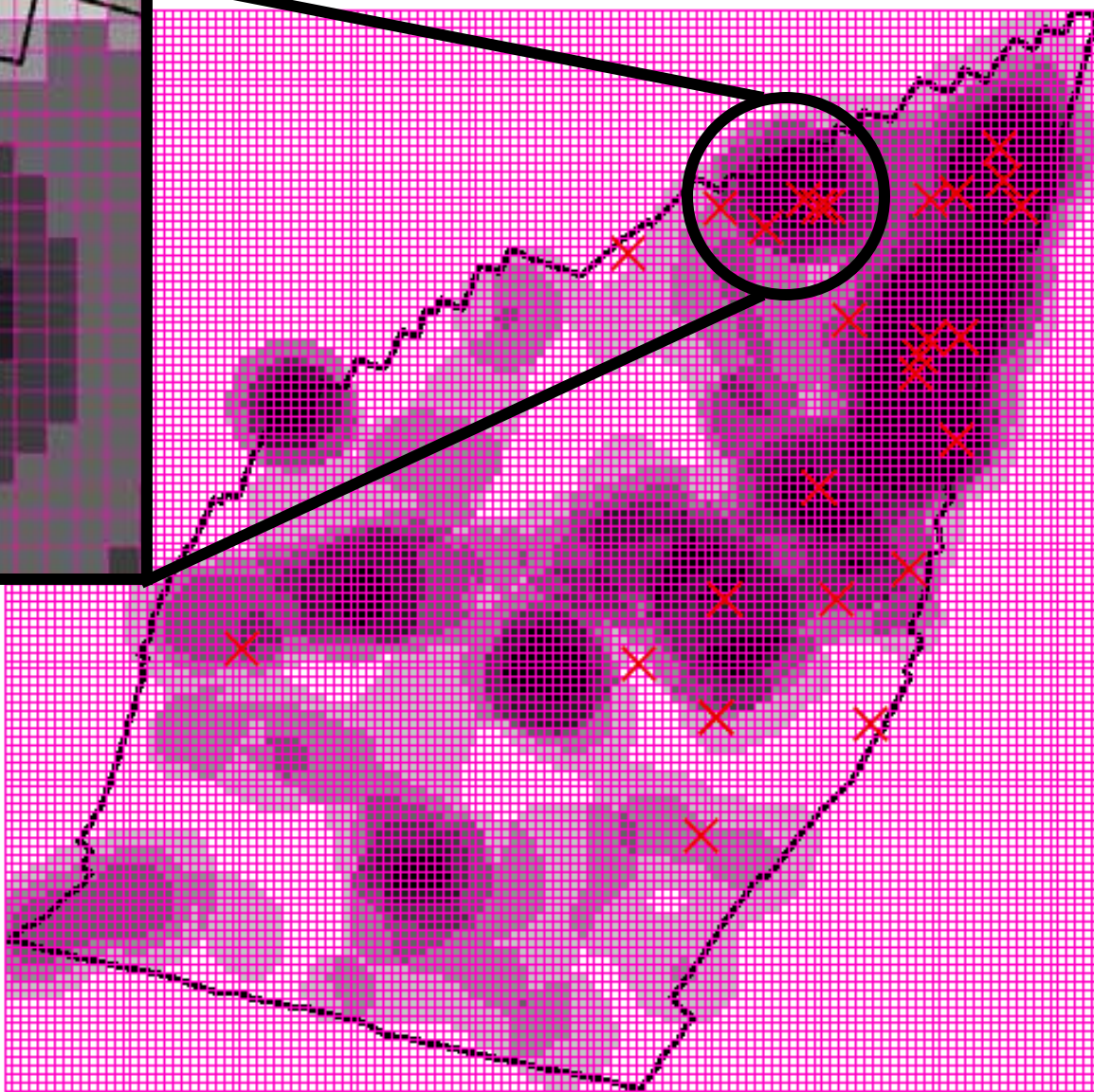
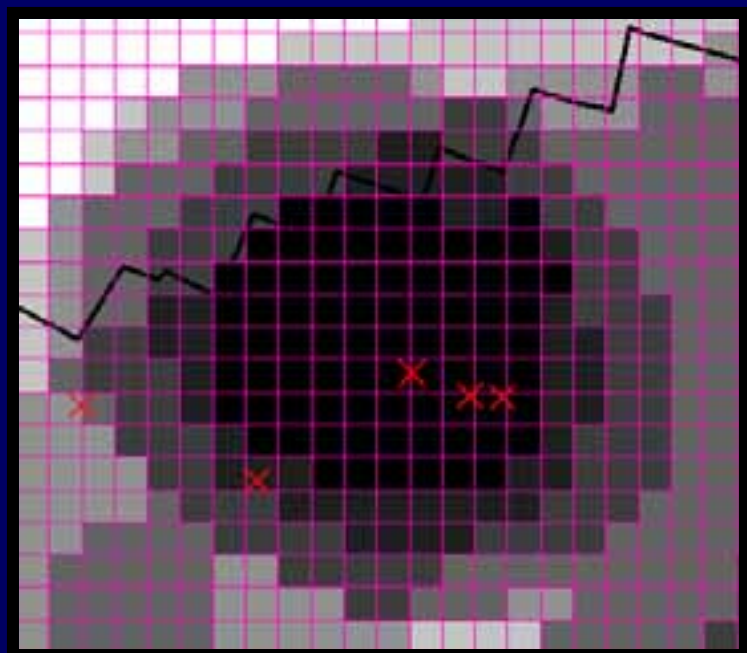


Figure 3: Risk Terrain and Shooting Overlay





Regression Analysis

Ind. Var. = Risk Value (0-8)

Dep. Var. = Presence of any Shooting (Yes/No)

TABLE 1: Logistic Regressions for Risk Value on Shooting

Period 1 Risk Terrain*

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
							Lower	Upper
Risk Value	.52	.097	29.06	1	<.001	1.69	1.397	2.048

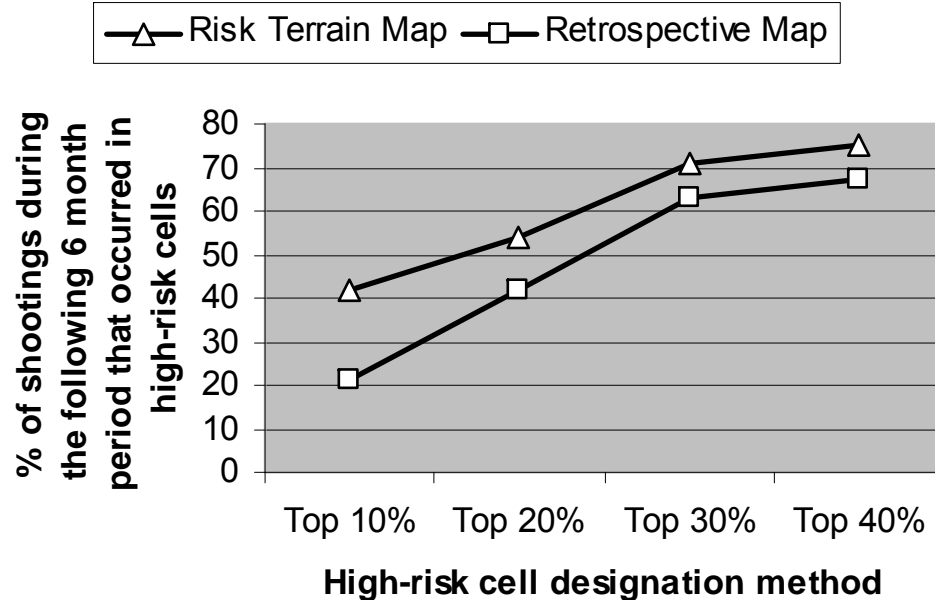
* -2 Log likelihood = 280.824; Nagelkerke R Square = .11; n=4046 street-intersected cells

Period 2 Risk Terrain**

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
							Lower	Upper
Risk Value	.44	.094	22.31	1	<.001	1.56	1.297	1.876

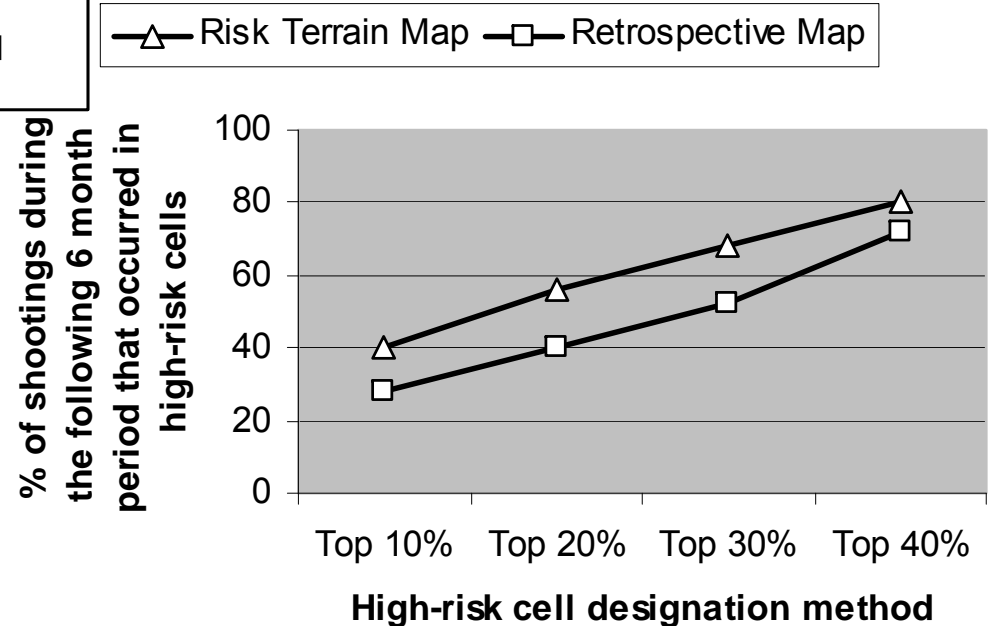
** -2 Log likelihood = 280.695; Nagelkerke R Square = .08; n=4046 street-intersected cells

Period 1



Risk Terrains: a statistically significant forecast of future shootings across a range of cut points; meaningfully more accurate than retrospective hotspot mapping.

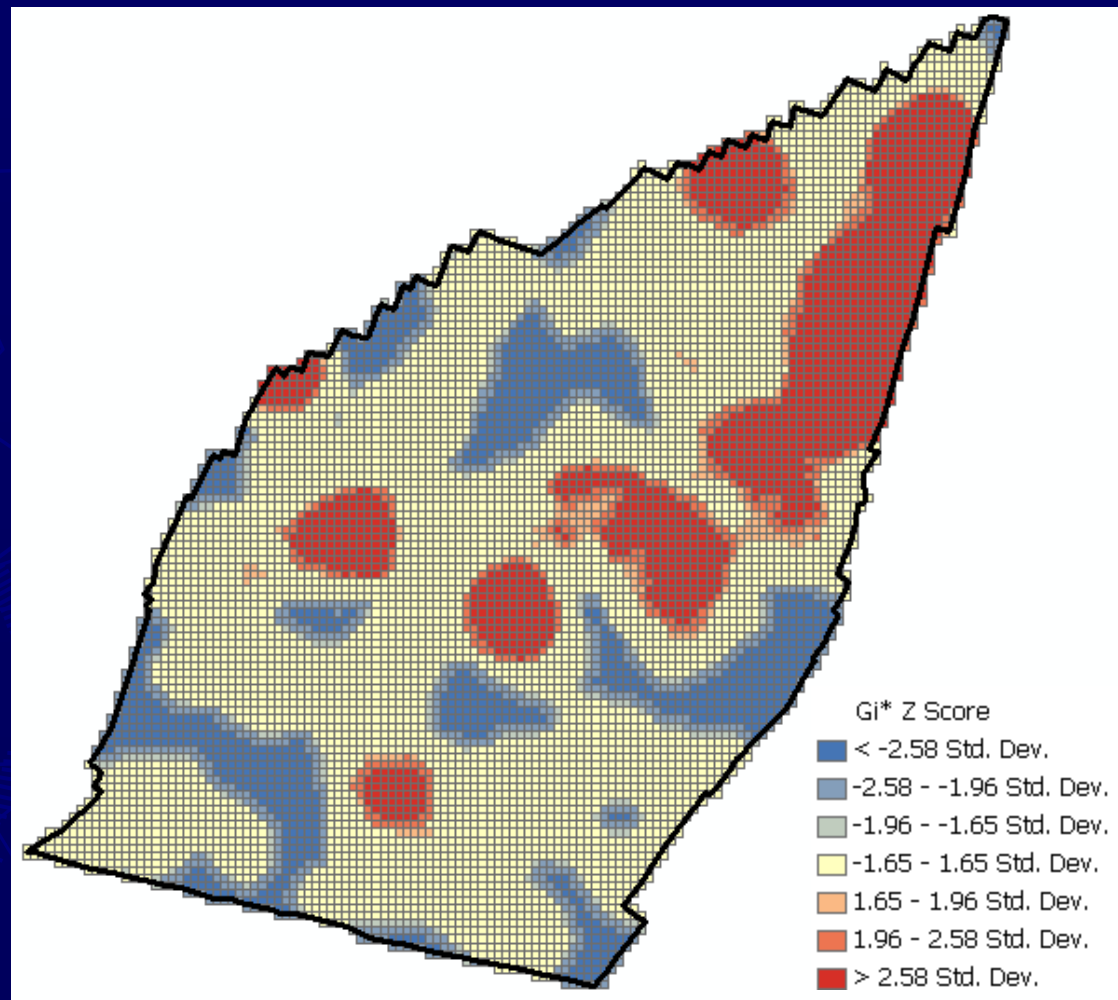
Period 2



Fisher's Exact Tests: everything is statistically significant at $p < 0.05$ except for Period 1 Retro, 10%

N cells = 4,046
N shootings = 24(P1), 25(P2)

High/Low “Risk Clusters” Have Operational Utility



Risk Terrain Modeling Overview

- ▶ Risk Terrains require the operationalization of all risk factors to a geography using justifiable methods.

Risk Terrain Modeling (RTM)

Repetition can be used to **evaluate** the interventions

Produces

Risk Terrain Maps

Which
Produces

Spatial Intelligence

Which aids in

Strategic Decision-Making

One or more interventions
can be targeted at one or
more risk factors in the RTM

So that...