

Buffers and Inverse Distances: Measuring the Proximity Effects of Criminogenic Land Uses on Fear and Crime

Eric S. McCord
Temple University



Introduction

- ◆ Opportunity theories: some land uses (LU) and facilities are criminogenic
- ◆ Opportunity exists at the LU, but may also extend into the neighborhood (proximity effects)
- ◆ Limitations with past LU studies:
 - ◆ Lack Nhd demographic controls
 - ◆ Few consider proximity effects
 - ◆ Lack spatial lags or use OLS regression with typical highly-skewed crime data



Why is a better understanding of LU important?

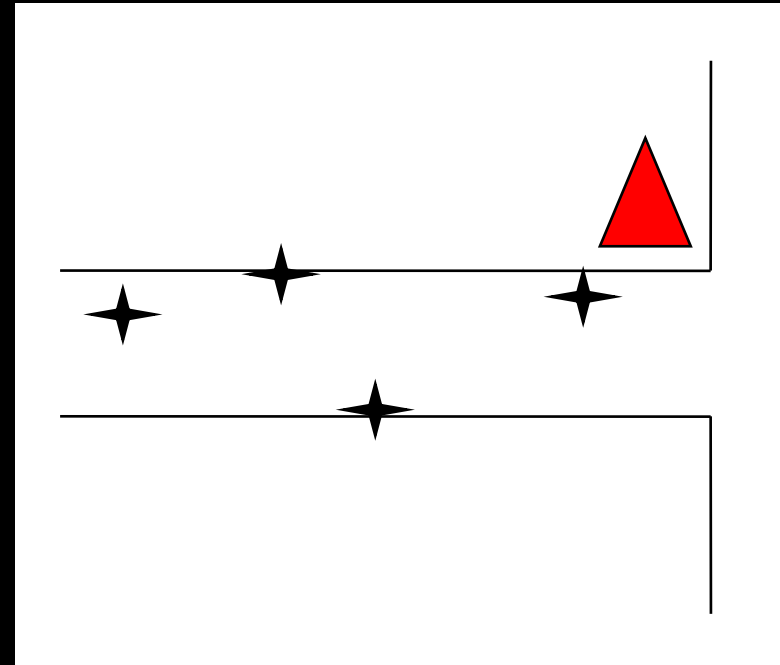
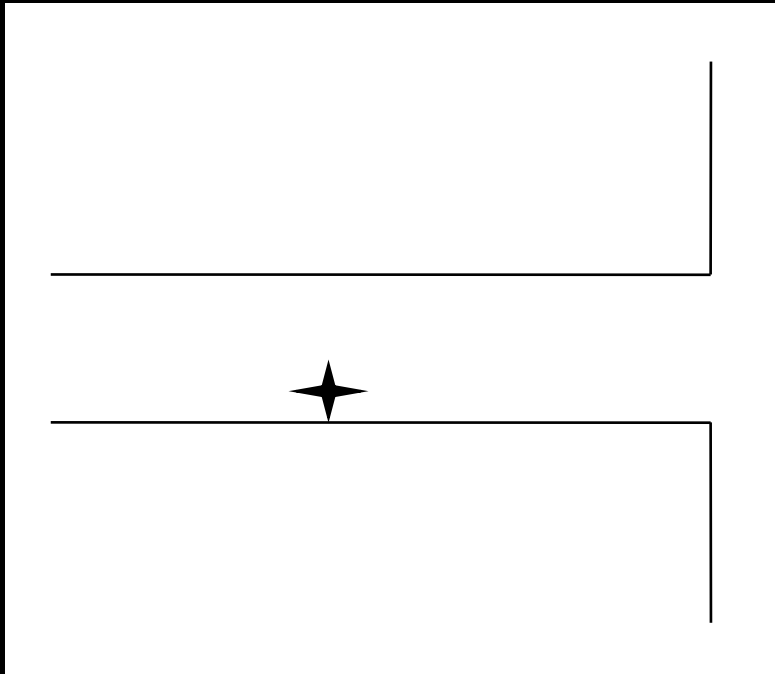
- ◆ Theory- interaction between social & built environment
- ◆ Crime prevention- think beyond property boundaries
- ◆ Urban planning- build safer cities & help reduce risk in existing problem neighborhoods?

*Special thanks to Professors Ratcliffe, Rengert and Taylor, and fellow grad student Travis Taniguchi



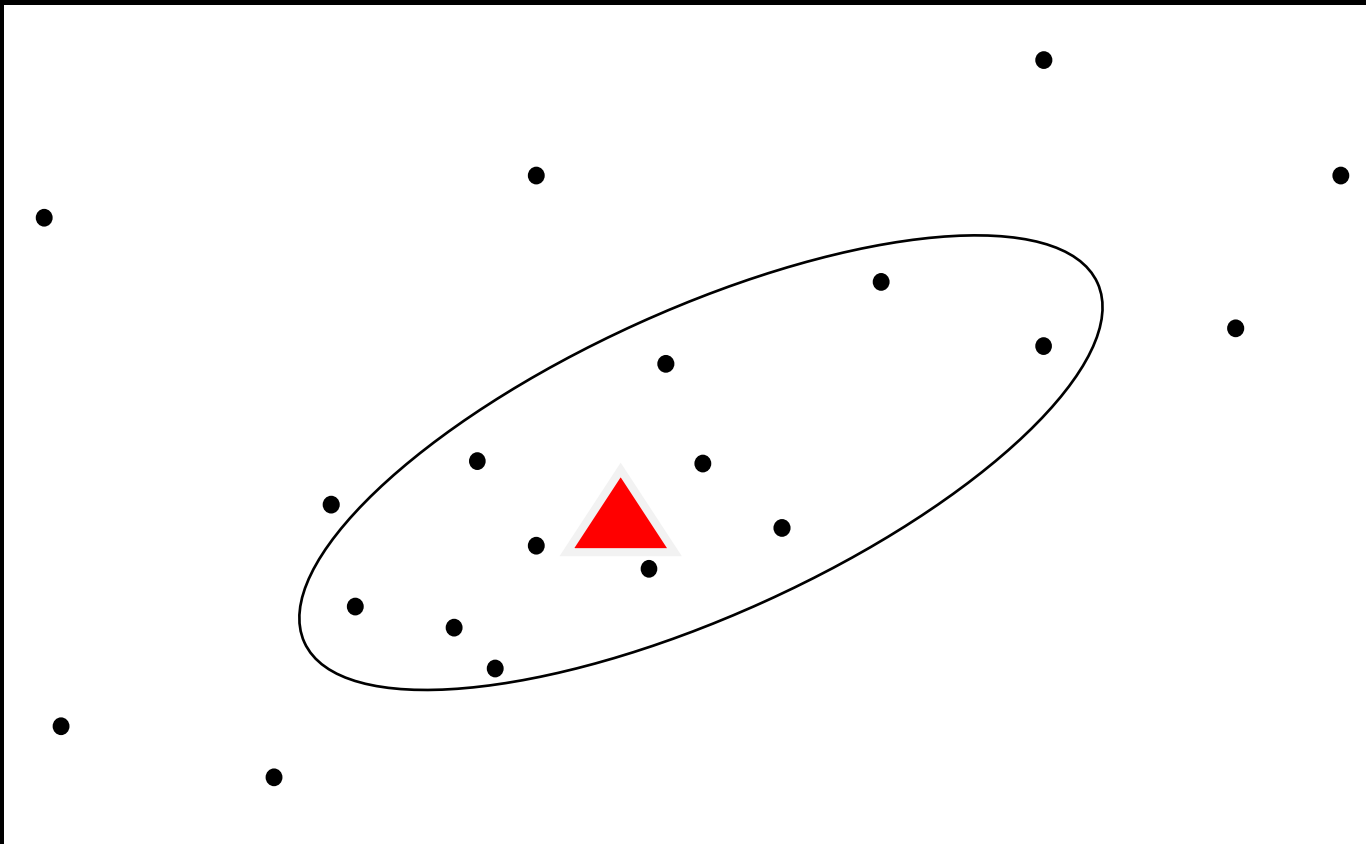
Common approaches: Crime incident counts

- ♦ Crime incident counts on street blocks (census blocks, tracts) without facilities, compared to incident counts on blocks with facilities



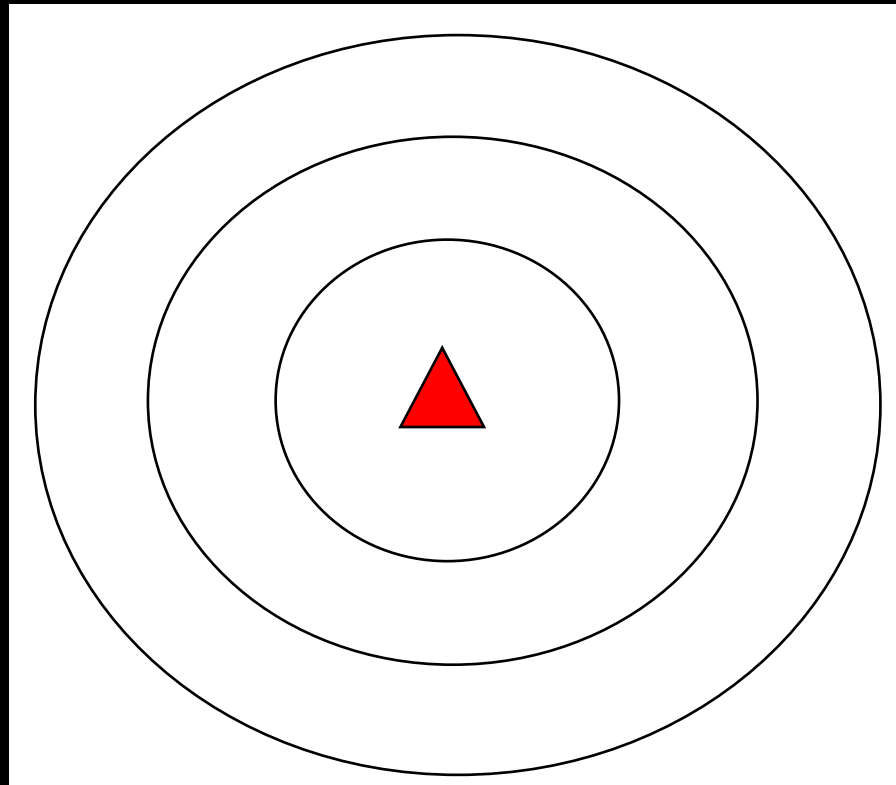
Common approaches : Hotspot relationship

- ◆ Theorized facilities or land use types observed in identified hot spots



Common approaches : Location quotients

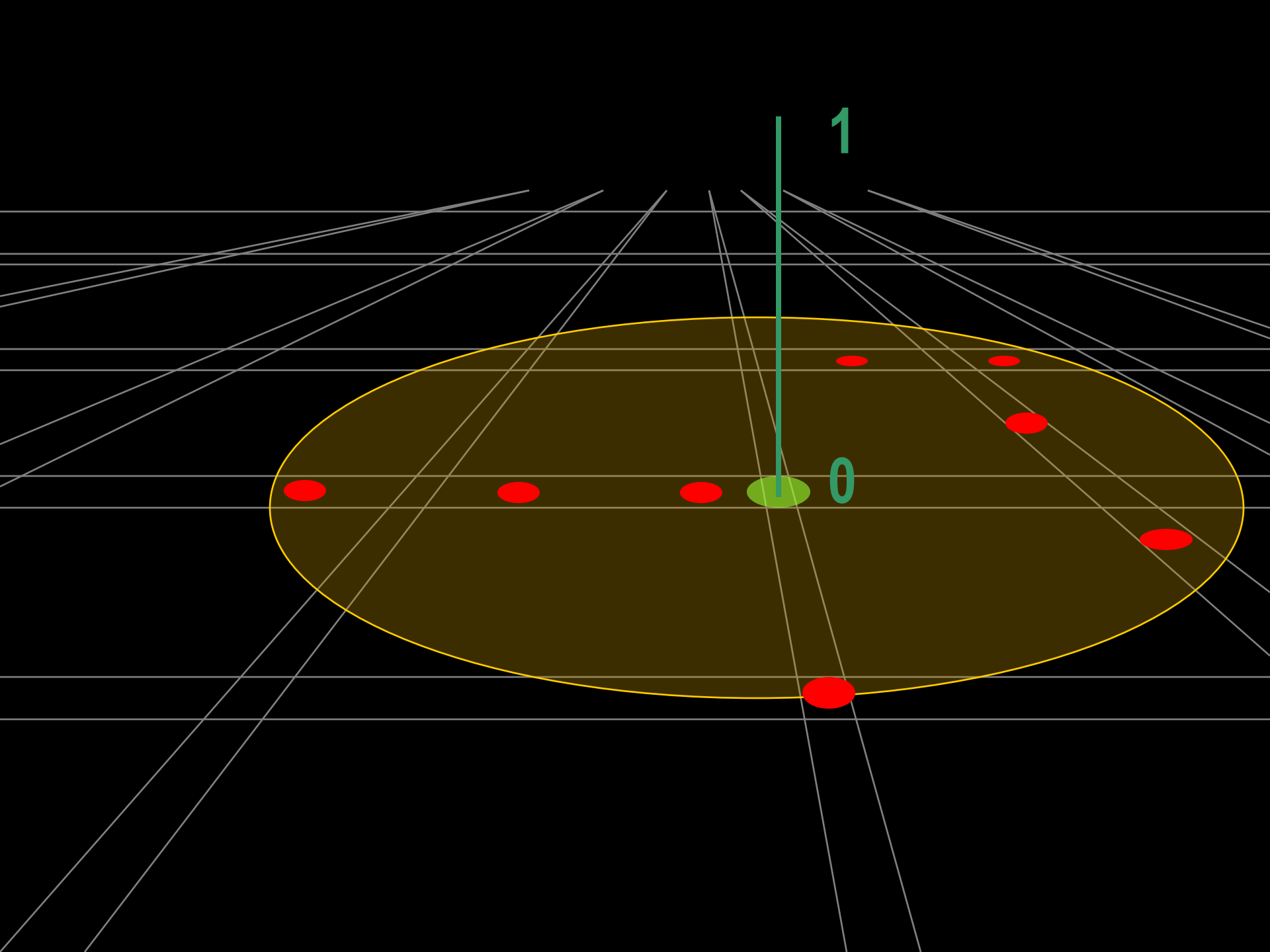
- ◆ Comparison between density (count/area) of crime incidents in buffers around facilities, to density of entire study area. Results in a ratio Eg: LQ 3.1

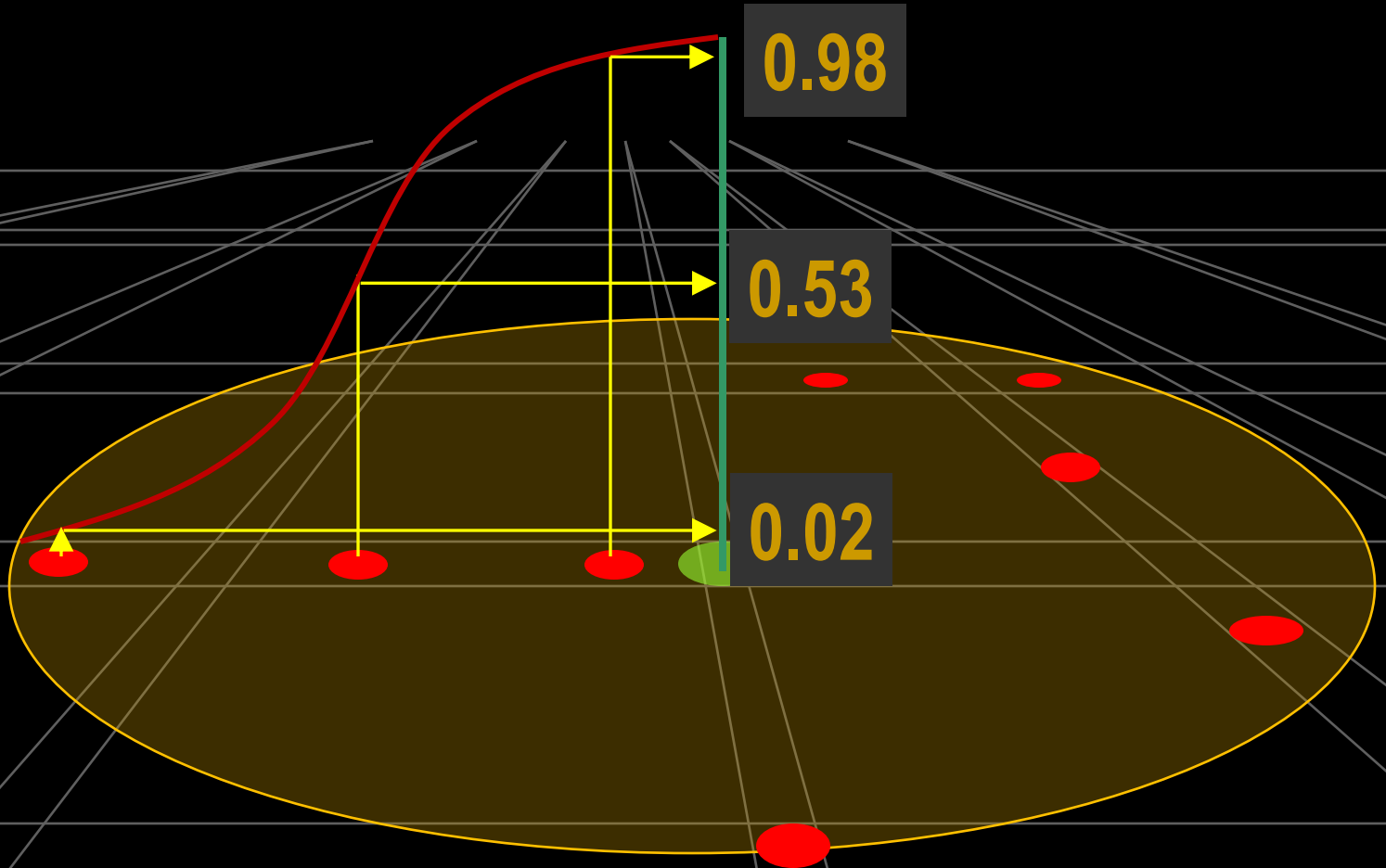


Method 1: Intensity value analysis (IVA)

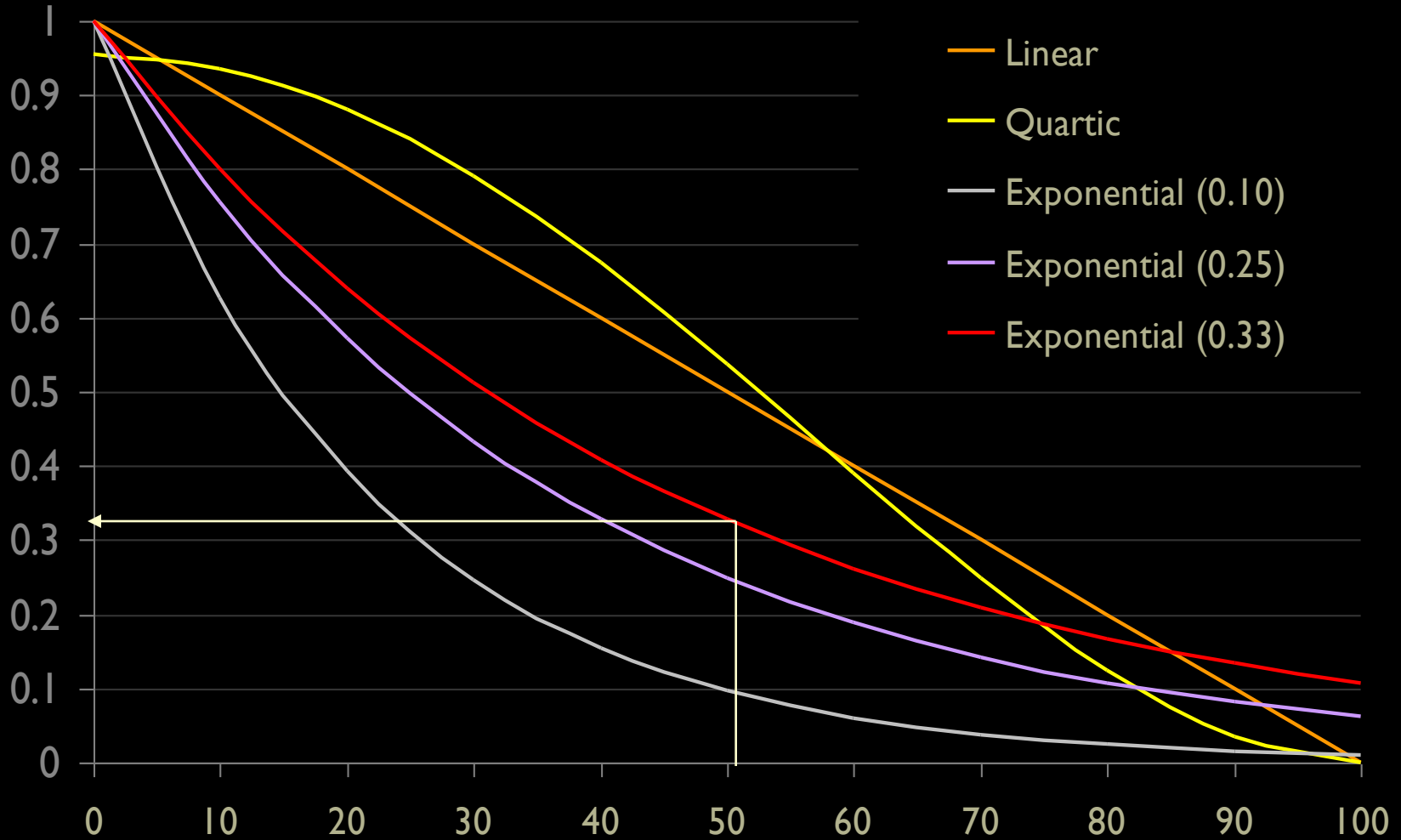
- ♦ **Objective:** Develop a simple way of evaluating theorized criminogenic LU & measuring proximity effects that can be used to compare across study areas, crime & LU types?
 - ♦ **Case study:** Subway stops and robbery in Philadelphia
- ♦ **Method:** Crime events falling within a selected bandwidth around LU are scored & summed using an inverse-distance weighting scheme







Inverse distance weighting options



Intensity value analysis

- ◆ IVA scores can be compared to
 - ◆ other facility or LU types
 - ◆ other crime types
 - ◆ a base standard such as a random sample of street corners or points
- ◆ Comparison accomplished two ways:
 - ◆ T-test of mean values
 - ◆ Comparison groups plotted in a histogram and visually analyzed

A case study...

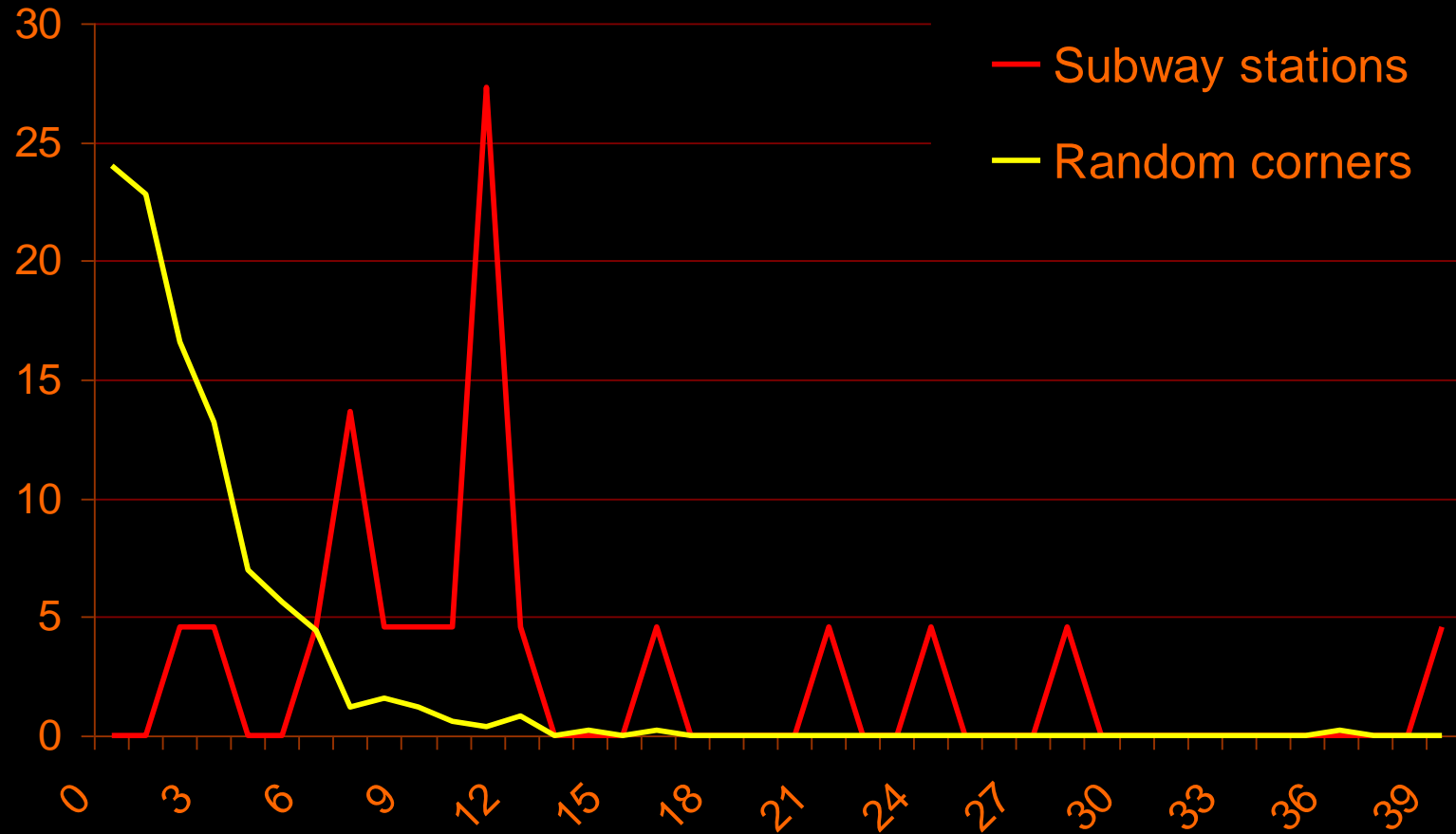


Case study: Broad Street subway line & robberies

- ♦ Mean intensity value for 500 random street corners = **2.1 (SD = 2.8)**
- ♦ Mean intensity value for subway stations = **11.7 (SD = 8.7)**
- ♦ One-sample t-test used (due to unequal group size)
 - ♦ Mean difference significant at **$p < .001$ (t = 5.183, df = 22)**
- ♦ Plotted in histogram...



Robbery intensity values



So what does this mean?

- ◆ Street robberies cluster around subway stops in Philadelphia at a much higher level than they do at random street corners throughout the city
 - ◆ Helps answer the question-A crime generator as compared to what?



Advantages & limitations

- ◆ Measures density & proximity
- ◆ Buffer size forgiving-too large a bandwidth less likely to “washout” effects
- ◆ Test of statistical significance
- ◆ IVA scores can be compared across study areas, crime, & LU types
- ◆ Scores do not indicate how many crime incidents occur in bandwidth
- ◆ Without controlling for neighborhood demographics, method alone is an exploratory analysis



Method 2: Proximity and the block group

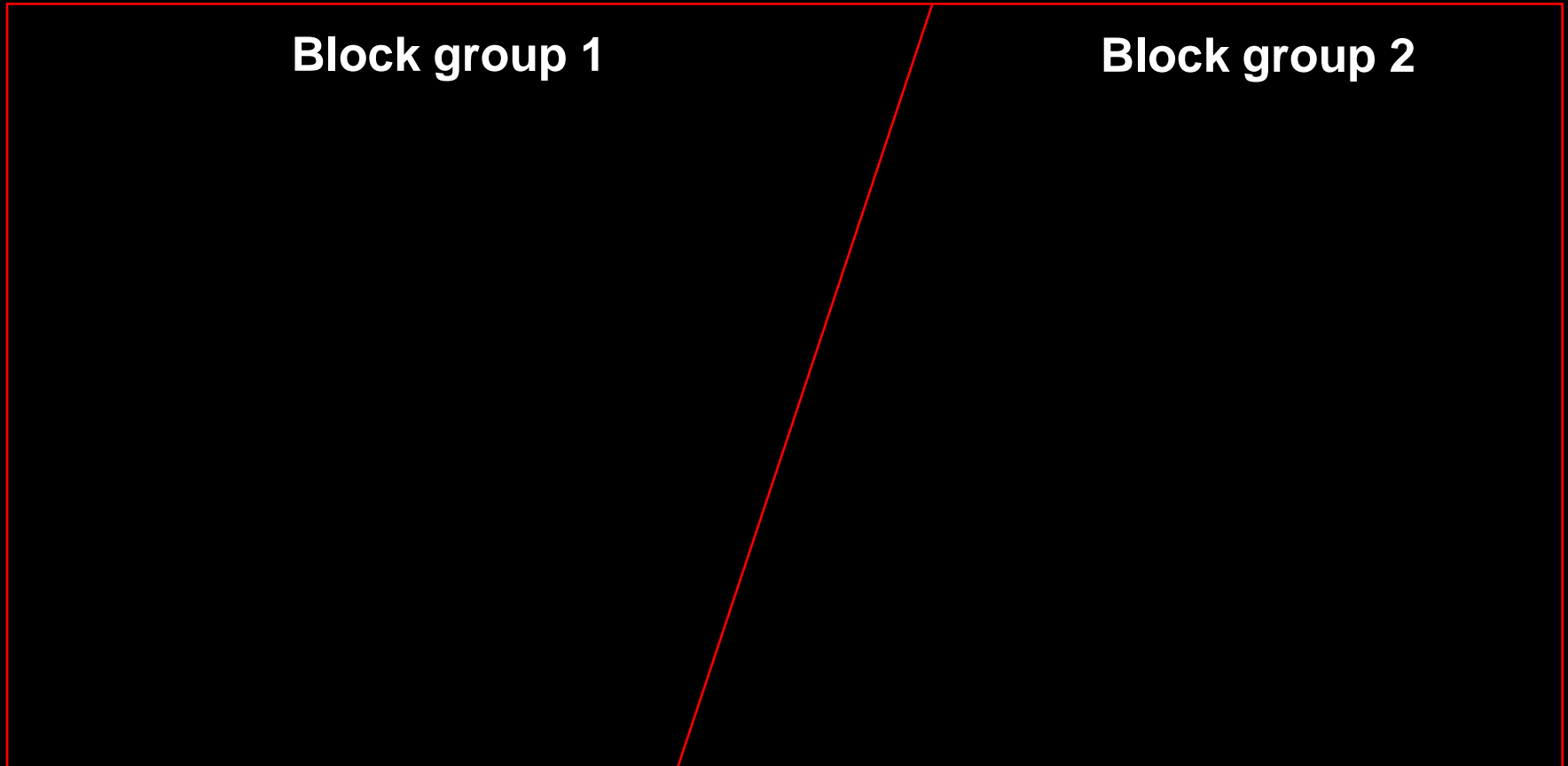
- ◆ **Research question:** Are criminogenic land uses related to the size and location of street drug markets in Philadelphia?
- ◆ **Method:**
 1. Identify possible crime generators
 2. Overlay localized opportunity buffers onto census block groups, and
 3. Calculate percentage of land area of BG that falls within buffers



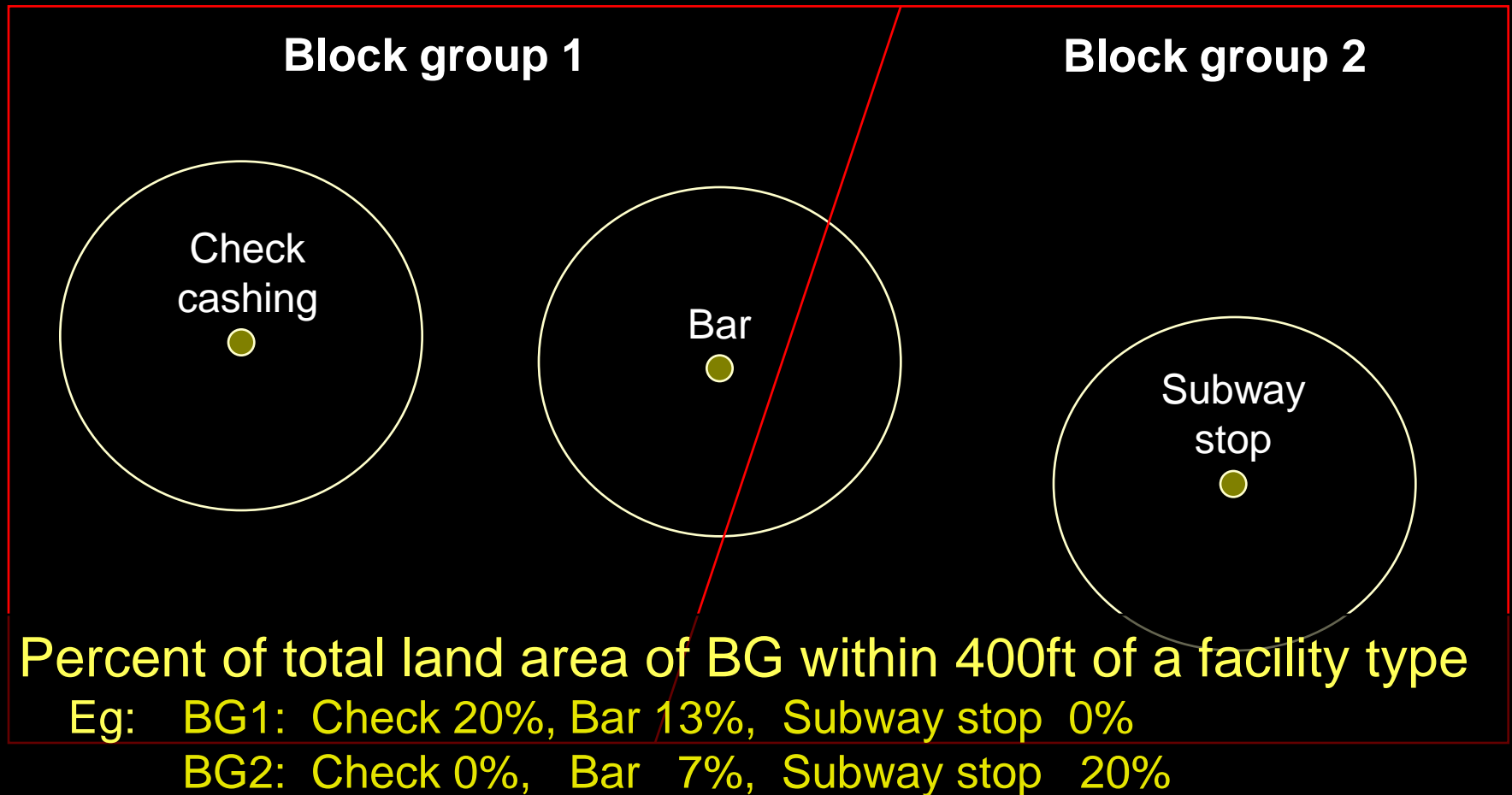
1. Identifying possible crime generators

Facility	n	0-400 ft	400-800 ft	800-1200 ft	1200-1600 ft
Beer Establishment	146	6.8	3.4	2.4	1.7
State Liquor Store	53	2.5	1.9	1.8	1.9
Check Cashing Store	96	4.9	3.7	2.8	2.2
Pawn Shop	30	7.2	4.7	3.3	2.3
Major Streets	22	0.4	0.6	0.7	0.8
Subway Station	49	4.6	2.5	1.9	1.5
Bus Station	1	2.5	2.0	0.2	0.6
Regional Train Stations	78	0.6	0.3	0.2	0.7
Expressway Off Ramps	120	0.2	0.3	0.1	0.4
Halfway House	41	5.2	6.1	4.1	4.1
Homeless Shelter	39	2.5	2.8	2.9	2.3
Drug Treatment (Outpatient)	20	3.6	4.7	4.9	3.2

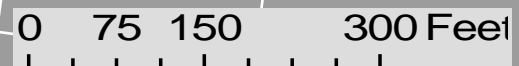
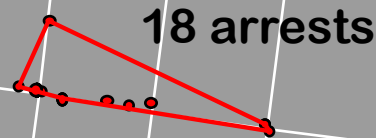
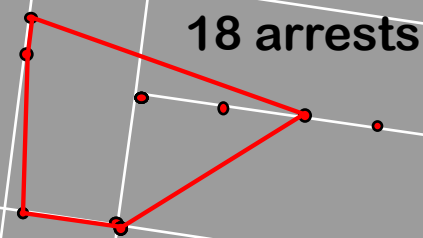
2. Overlay opportunity buffers onto census block groups



2. Overlay opportunity buffers onto census block groups



Drug Markets in Philadelphia Identified by CrimeStat



Predicting Drug Market Placement	Model I Demos	Model II Add facilities	Model III Add sp lag
% 15-29yrs old	ns	ns	ns
% Unemployed	ns	ns	ns
% No HS Diploma	+	+	ns
Conc Disadvantage	+	+	+
Heterogeneity	ns	ns	ns
% < 5yrs Address	ns	ns	ns
Median Income	ns	ns	ns
Area (control)	+	+	ns
Pawn Shop		ns	ns
Check Cashing		+	+
Beer Establishment		+	+
State Liquor		ns	ns
Main Street		ns	ns
Subway Stop		-	ns
Spatial Lag			+
Pseudo R ²	30.3	33.3	40.3

Predicting Count Drug Sales Arrests	Model I Demos	Model II Add facilities	Model III Add sp lag
% 15-29yrs old	ns	-	-
% Unemployed	ns	ns	ns
% No HS Diploma	+	+	ns
Conc Disadvantage	+	+	+
Heterogeneity	+	+	ns
% < 5yrs Address	-	-	-
Median Income	-	-	-
Area (control)	-	-	ns
Pawn Shop		ns	ns
Check Cashing		+	ns
State Liquor		ns	ns
Beer Establishment		+	+
Main Street		-	-
Subway Stop		ns	+
Spatial Lag			+
Pseudo R ²	9.3	10.0	12.1

So what does this mean?

- ◆ Drug market locations are not random with ref to either the type of neighborhood, or locations within a neighborhood
- ◆ Locating near a check cashing center or beer establishment may provide specific advantages to drug markets
- ◆ Where drug market exist, they tend to be larger in neighborhoods near beer establishments & subway stations, and smaller if located near main streets



Advantages & limitations

- ◆ Merges Nhd structure with opportunity factors
- ◆ Reduces problem of edge effects by including proximity effects when buffer overlaps into adjacent BG
- ◆ May not catch the full impact when two or more land use buffers overlap in same BG
- ◆ MAUP and other issues when using census units for analysis



Where do we need to go with this?

- ◆ Interactions
 - ◆ land use x land use
 - ◆ land use x neighborhood structure
- ◆ Qualitative research
- ◆ Studies of suburban & rural areas
- ◆ Continue to identify criminogenic land use types



Buffers and Inverse Distances: Measuring the Proximity Effects of Criminogenic Land Uses on Fear and Crime

Eric S. McCord
emccord@temple.edu

IVA software available at www.jratcliffe.net

