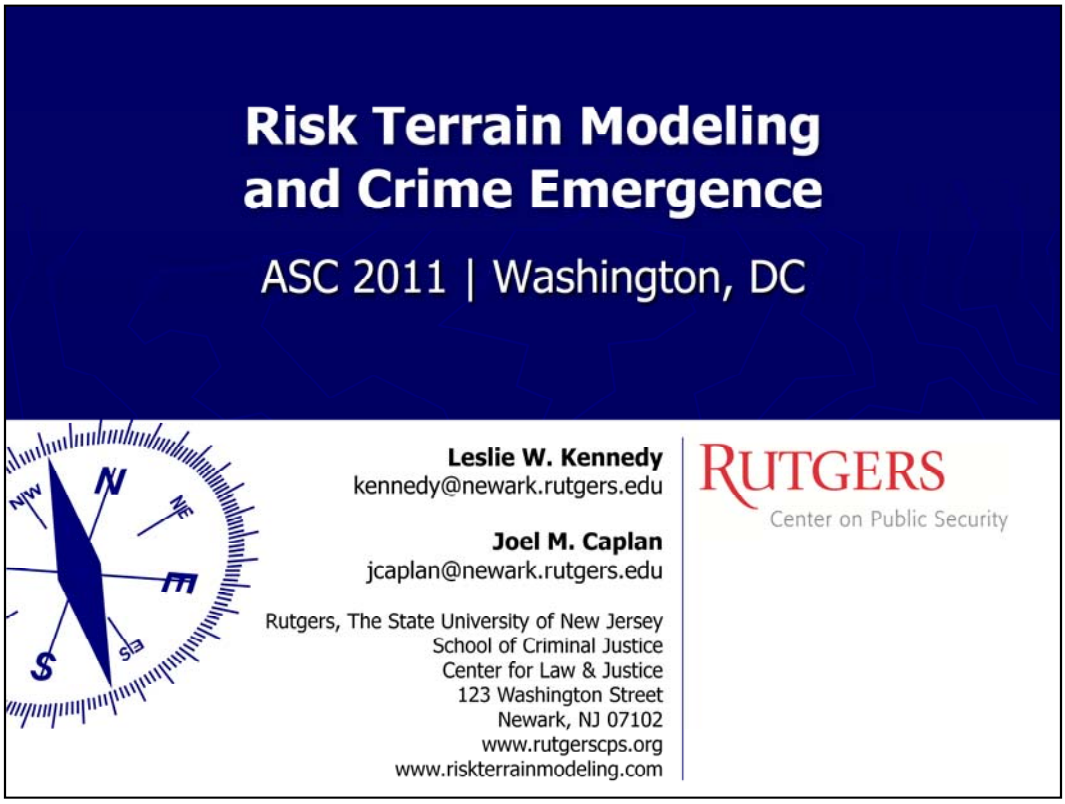
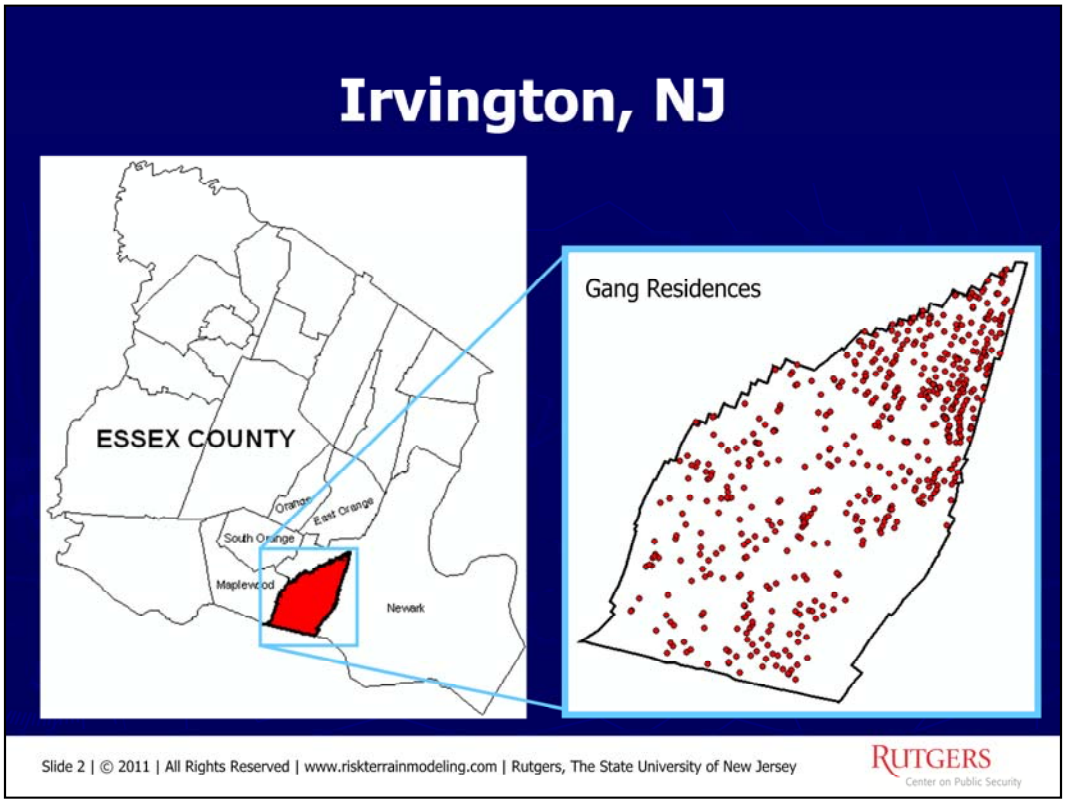



Risk Terrain Modeling (RTM) is an approach to risk assessment that standardizes all risk factors to common geographic units, then combines separate map layers o produce “risk terrain” maps showing the presence, absence, or intensity of all risk factors at every location throughout the landscape. It "paints a picture" of place-based context for crime emergence. This permits the forecasting of future crime locations not because crimes occurred there yesterday, but because the environmental conditions are suitable for crimes to occur there tomorrow.




The idea for RTM emerged out of collaboration with the New Jersey State Police and their focus on Irvington, NJ.

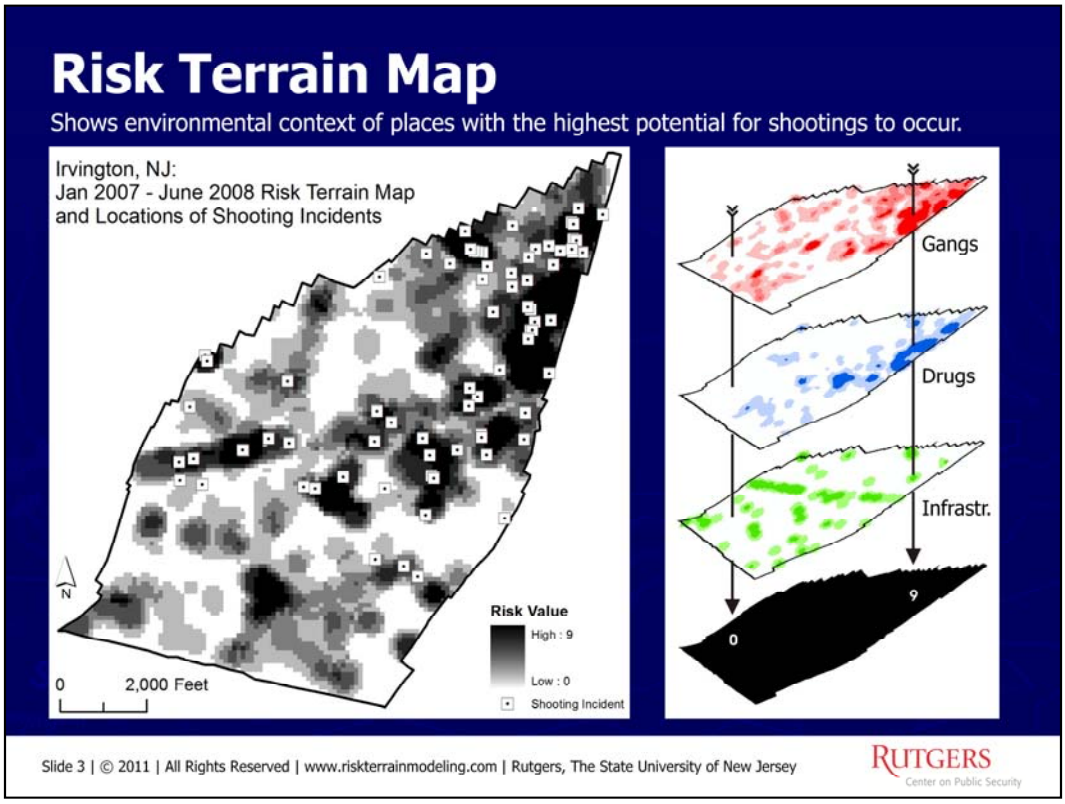
• Murder rates in 2007 were 38.7 per 100,000, compared to a national average for similar size cities across the country of 4.9 (UCR, 2007).

• The growth of violence led the State Police to set up a special task force to police this area as a supplement to the municipal police.

• As an immediate result, there was an increase in drug arrests and a reduction of shootings—which then began to plateau.

• Police executives looked for more robust analyses of their data. This is how we got involved.

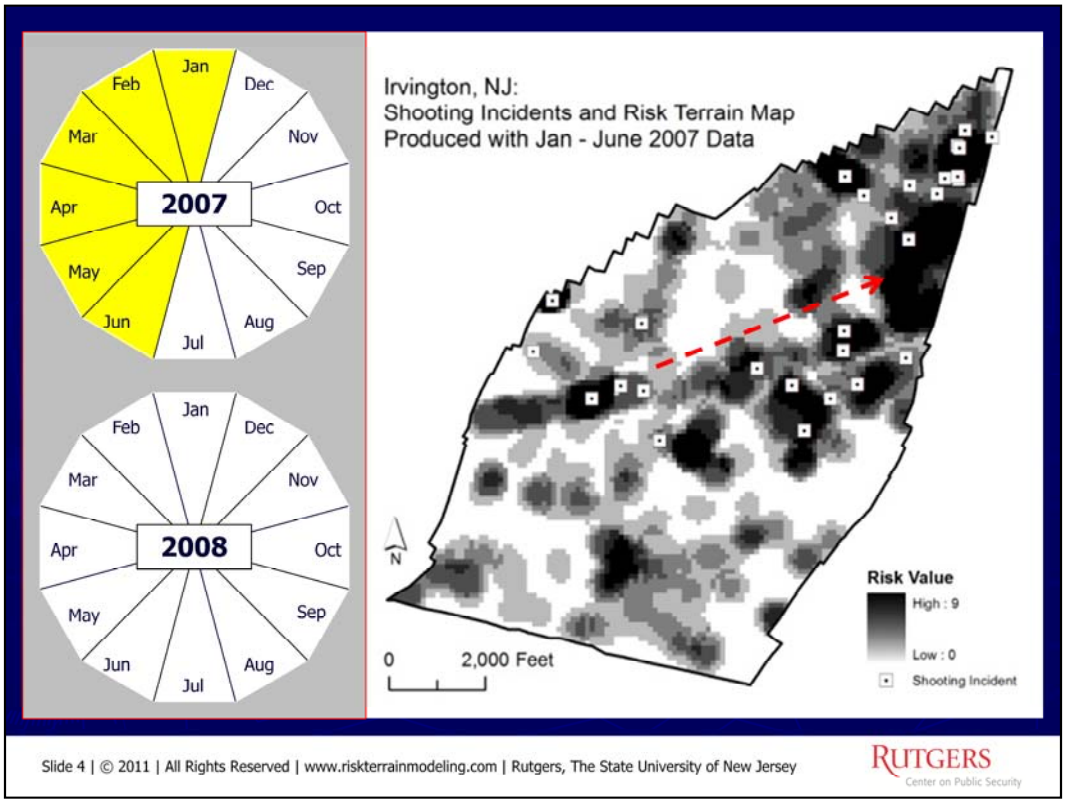
At the outset, we were given only four sets of data--Gang Residences, Drug Arrests, Infrastructure, and Shootings. We started by creating point maps and looking for relationships among these variables.




If each individual factor is related to shootings, then all factors together must be more related. So we developed a methodology that creates a single “risk terrain” map. Imagine a “risk terrain” as a weather map that forecasts areas with the greatest potential for crime to occur. Just as a meteorologist incorporates multiple factors such as barometric pressure or air temperature when creating a weather map, so too must a crime analyst consider multiple factors when creating a risk terrain. Individual factors that are incorporated into weather maps do not necessarily produce thunder storms or hurricanes by themselves. It is only when they intersect in space and time that they have the greatest potential to yield a particular outcome. The same is true for crime.

This slide shows the final risk terrain map, which is a composite map of three individual layers: gangs, drugs, and infrastructure. Clusters of risk in the new composite “risk terrain” map closely matches locations of actual shootings over a 18 month period for which gang, drug and infrastructure data was used. While this is intriguing, it doesn’t really yield much more information than what hotspot maps of 18 months worth of shooting incidents could provide. That is, until we consider time.

When we made risk terrain (RT) maps for separate 6 month time periods, we noticed that high risk clusters of earlier RT maps forecasted the locations where shootings would occur during the next time period. In the next few slides, Watch shooting incidents disperse East, South, and then to the West—as suggested to happen by the Risk Terrain map from the previous time period.



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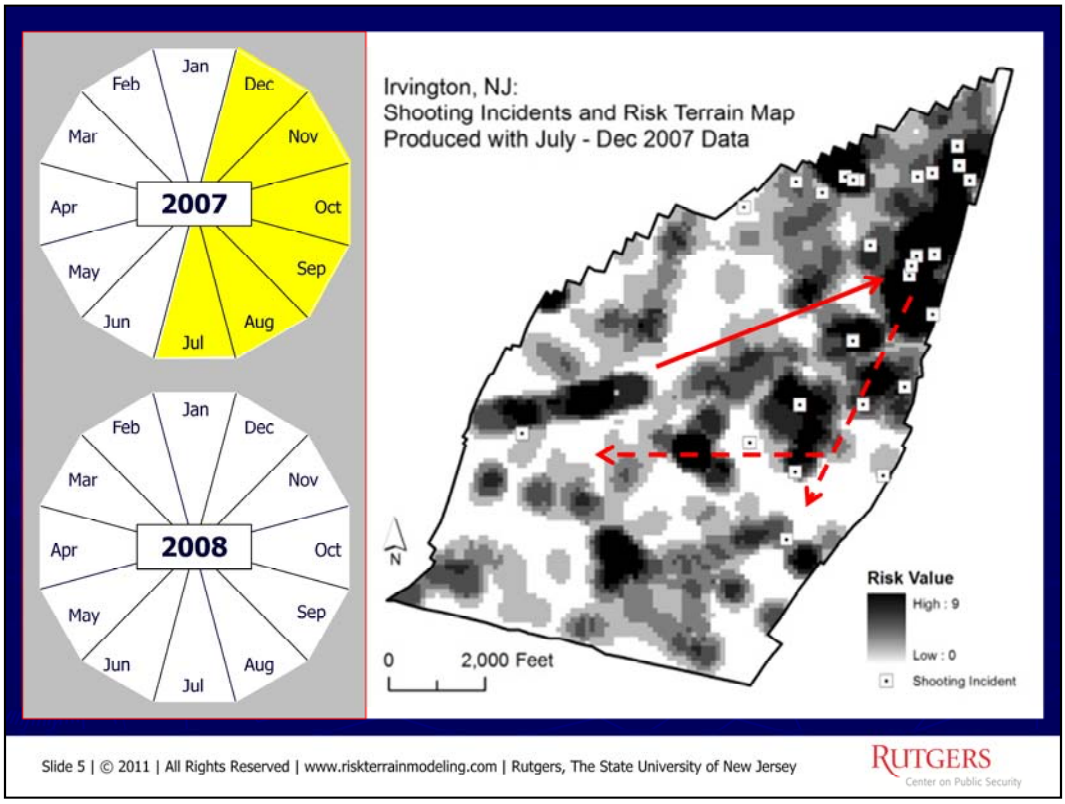




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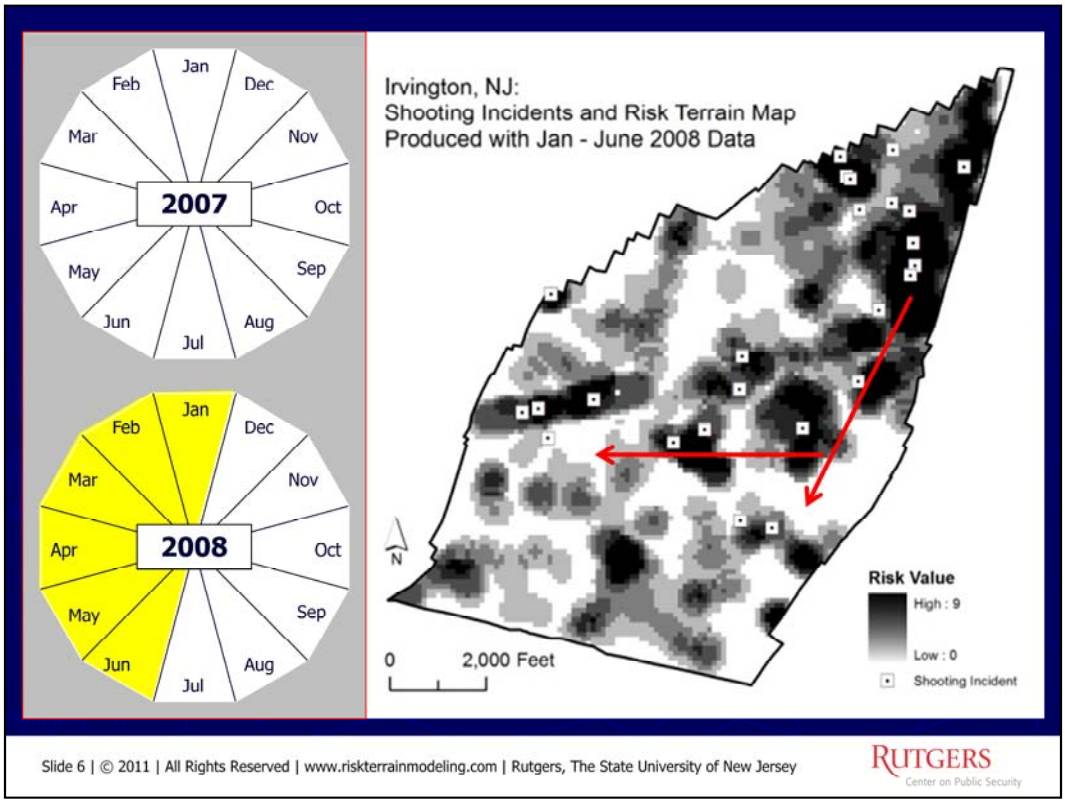


As part of the Police Taskforce, drug arrests were targeted at different locations over time and this tactical shift in police activity from the Northeast to the south and then to the west, roughly matches the movement of shootings, and is consistent with these periodic risk terrain maps. Given that drug activity was the most dynamic factor of these inaugural risk terrain maps, this risk terrain model served as an evaluation of the impact of police activities, while "controlling" for other environmental contexts (i.e. gang residences and infrastructure).

It is also apparent from these maps that shootings did not always occur in the future at places where they mostly occurred in the past. This suggests that a sole reliance on conventional hotspot mapping to predict future shooting locations would have been less than effective.

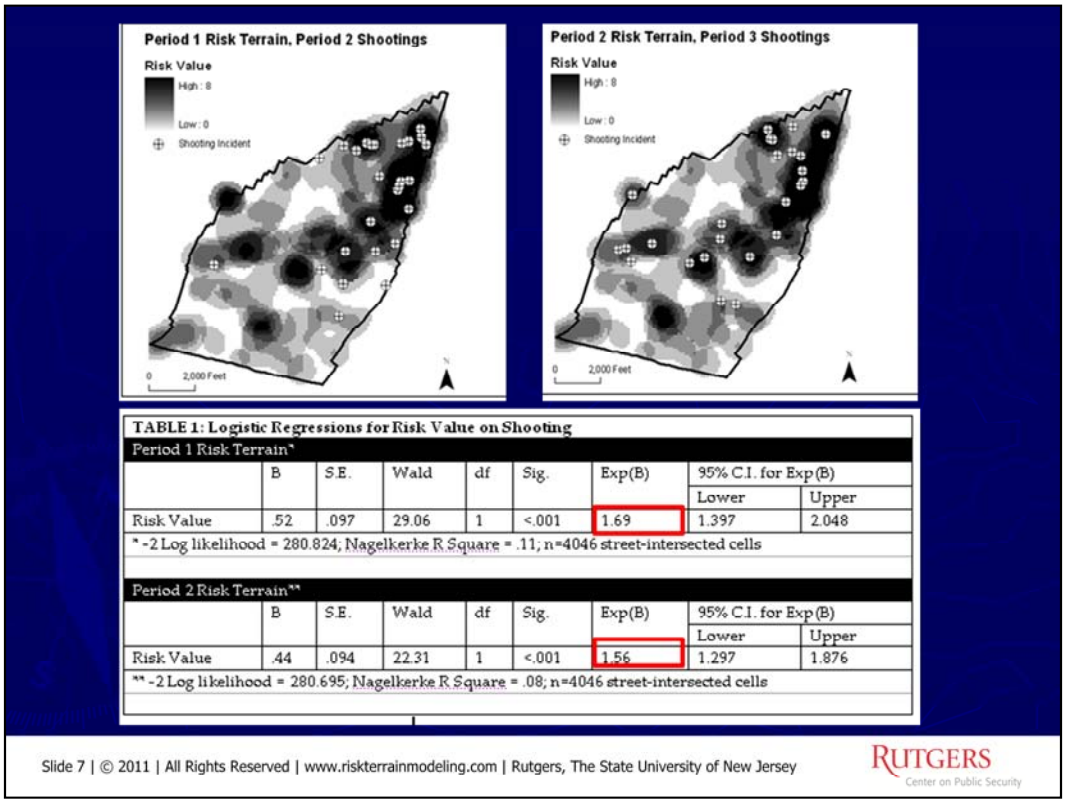


**TABLE 1: Logistic Regressions for Risk Value on Shooting**

| 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 | | | | | | | | |



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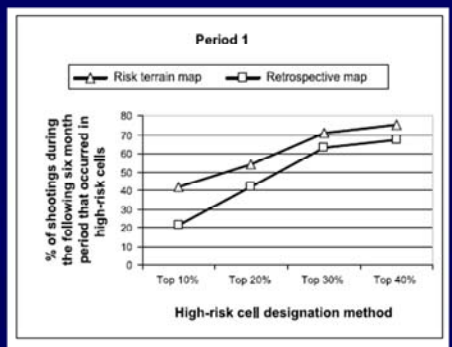
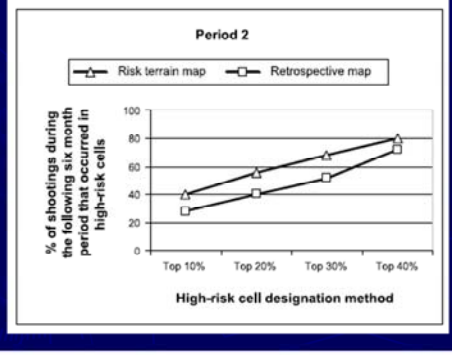
On this slide are two risk terrain maps. The period 1 risk terrain map has shootings from period 2 on top of it (Left map). The Period 2 risk terrain map has period 3 shootings on top of it (right map). Predictive validity was tested using risk values from the earlier time period as the independent variable and the presence or absence of shootings from the next time period as the dependent variable. It turns out that RTM does have statistically significant predictive validity. As you can see from the results of a logistic regression, shown in Table 1, for every increased unit of risk in a 100ft x 100ft place, the likelihood of a shooting happening there increases by 69% for the Period 1 RT and 56% for Period 2 RT.




- **Risk Terrain Maps** yield a statistically significant forecast of future shooting locations across a range of cut points.



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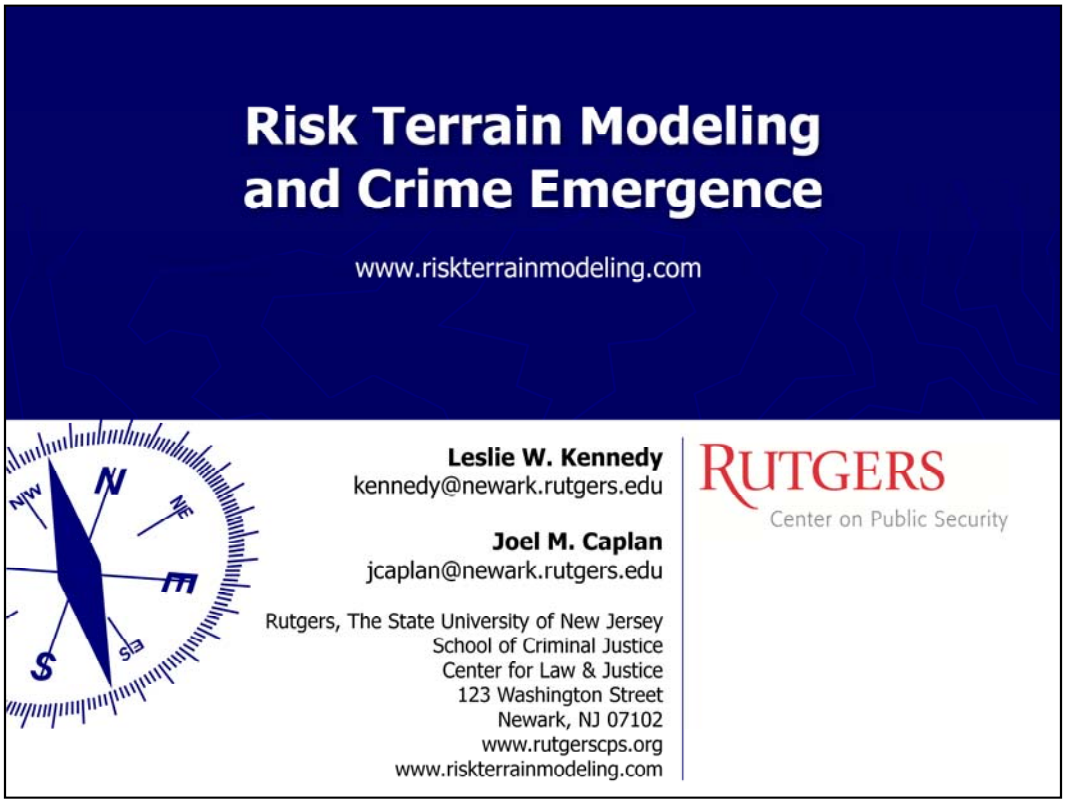


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