

SPATIAL MAPPING OF SOCIAL NETWORKS

King County Prosecutor's Office
Police-Prosecution Partnership (3PI)
August 2-4, 2017

Presented by Julie Wartell

MAPPING PEOPLE & PLACES TOGETHER

WHY PUT SNA & GIS TOGETHER

Crime Pattern Theory
(Brantingham & Brantingham)



Routine Activity Theory
(Felson & Cohen)



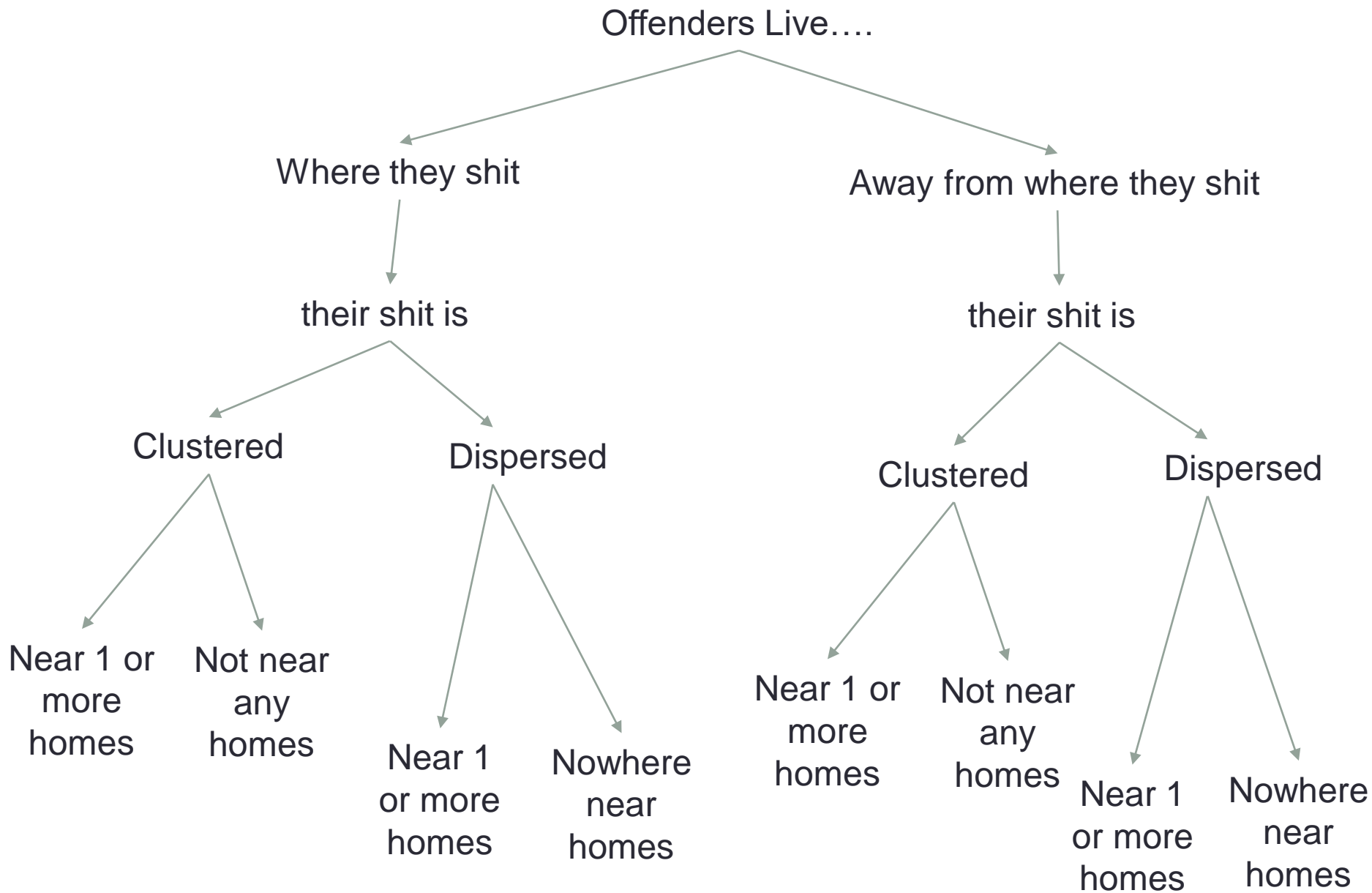
Rational Choice Theory
(Cornish & Clarke)



**PROLIFIC OFFENDERS HAVE
GEOGRAPHIC PREFERENCES**

What types of patterns can be revealed about the networks?

- Where they live in relation to where they commit crimes
 - Clustered
 - Crimes clustered near 1 or more homes
 - Crimes clustered but not near any homes
 - Dispersed
 - Crimes spread out but homes are clustered/nearby
 - Crimes spread out and nowhere near homes
- Live in one jurisdiction but commit crimes in another
 - Crimes and/or Homes Clustered v. Dispersed
- Arrest location
 - Near or far from home and/or crime locations



OK... what do we do with this info?

- Do more analysis of course!
 - Examine clusters within the maps
 - Assess relationships of the people to the places
 - Collect more info...
 - More locations for individuals
 - More relationship data on connected individuals (relative, friend, etc.)
- Focus efforts based on social **and** spatial connections

SNA & GIS EXAMPLES FROM THE FIELD

Jackson, MS & Linn County, IA

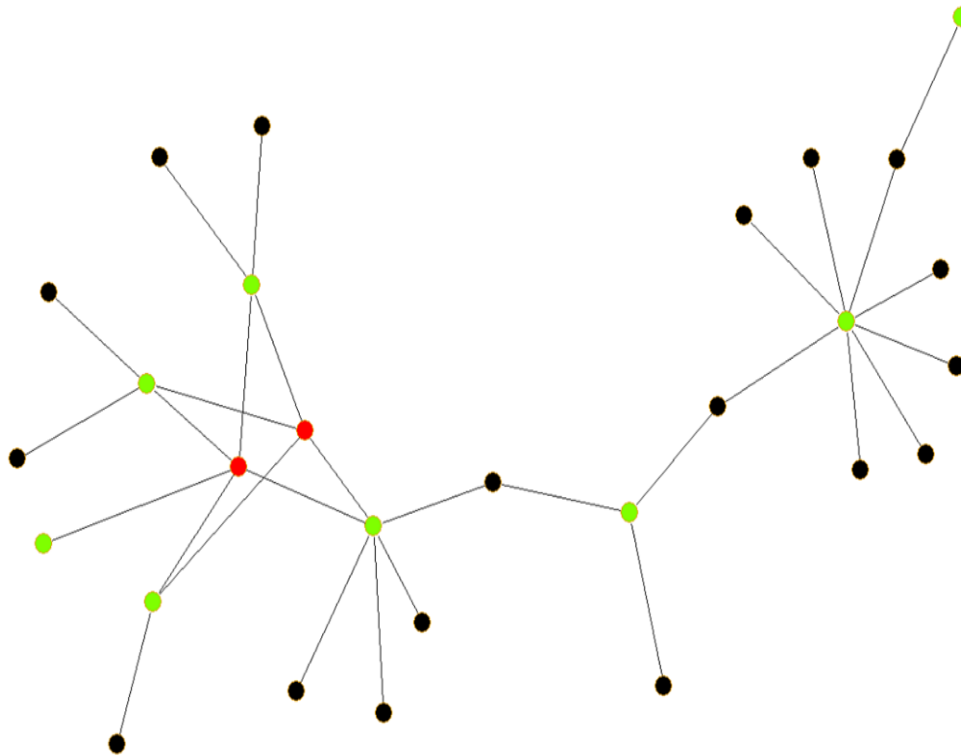
Jackson, MS PD

- Data from Dec 1, 2014 – Nov 30, 2016
 - Crime Reports
 - Arrests
- Analytic Strategies
 - Geographic
 - overall violent* crime and gun-related hot spots
 - cluster locations
 - Network analysis – clustering of individuals associated through arrests

**We defined “violent” crime to include the following categories: murder; rape and sexual battery; robbery; assault (aggravated and simple); shootings; and firearm and weapon violations. It should also be noted that only aggravated assaults, shootings and some weapon violations specifically state a gun was involved; with the data provided, we were unable to determine which murders, rapes and robberies were gun-related.*

Jackson: Social Network Analysis

Two-mode co-arrest network, violent cluster 1 without labels



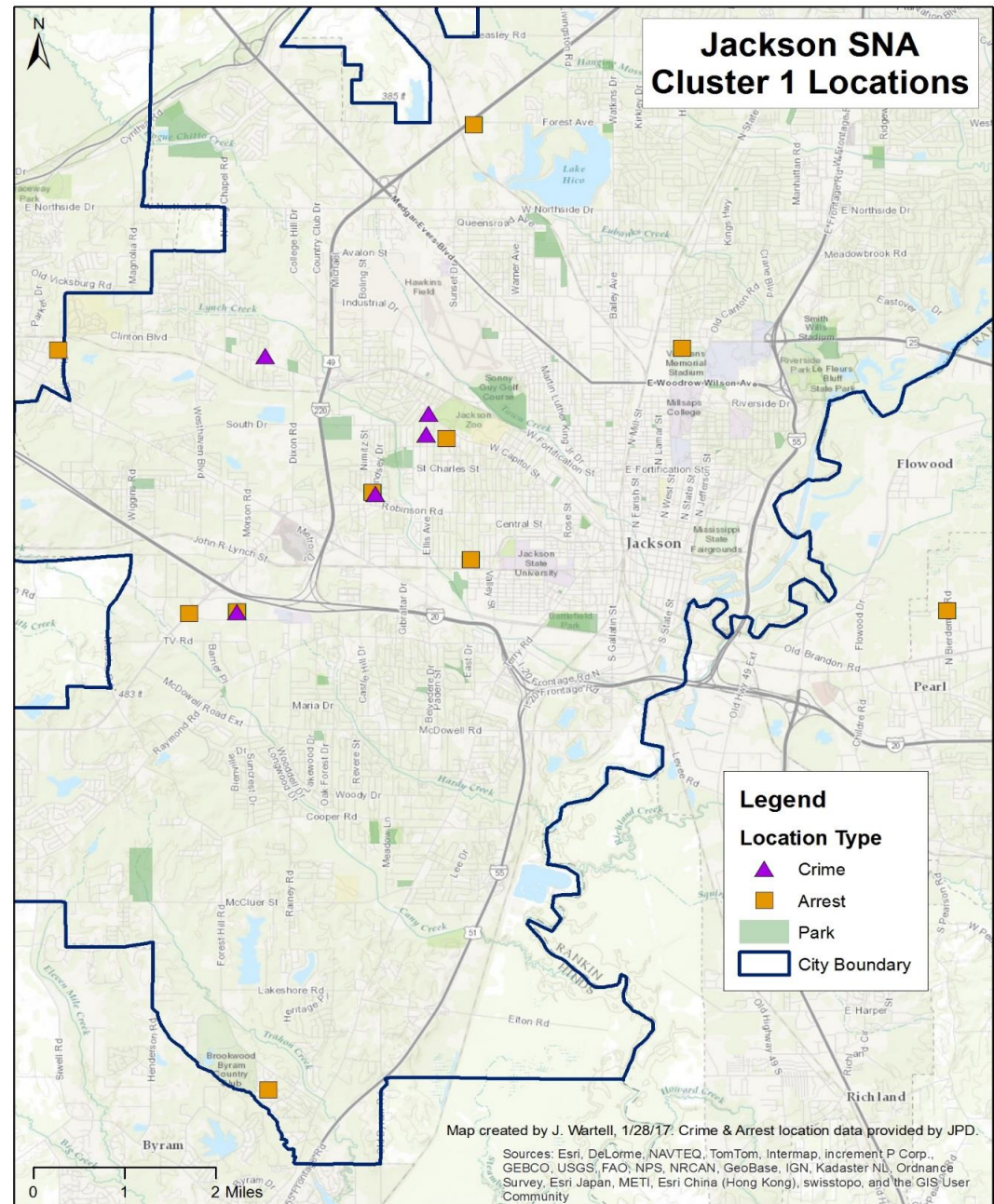
Note:

Black = non-violent
incident

Red = violent
incident

Green = person

Jackson: SNA on a Map



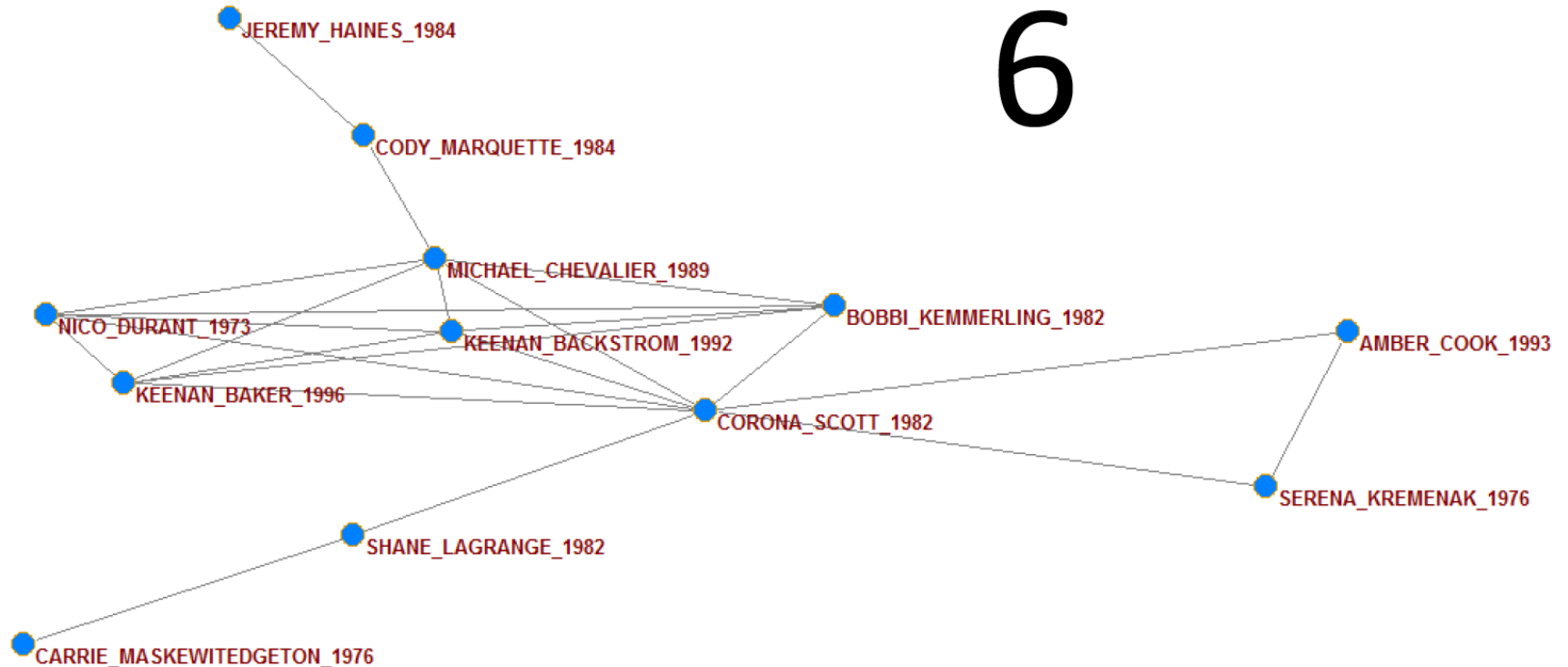
Linn County, IA

(Cedar Rapids, Marion, Linn County)

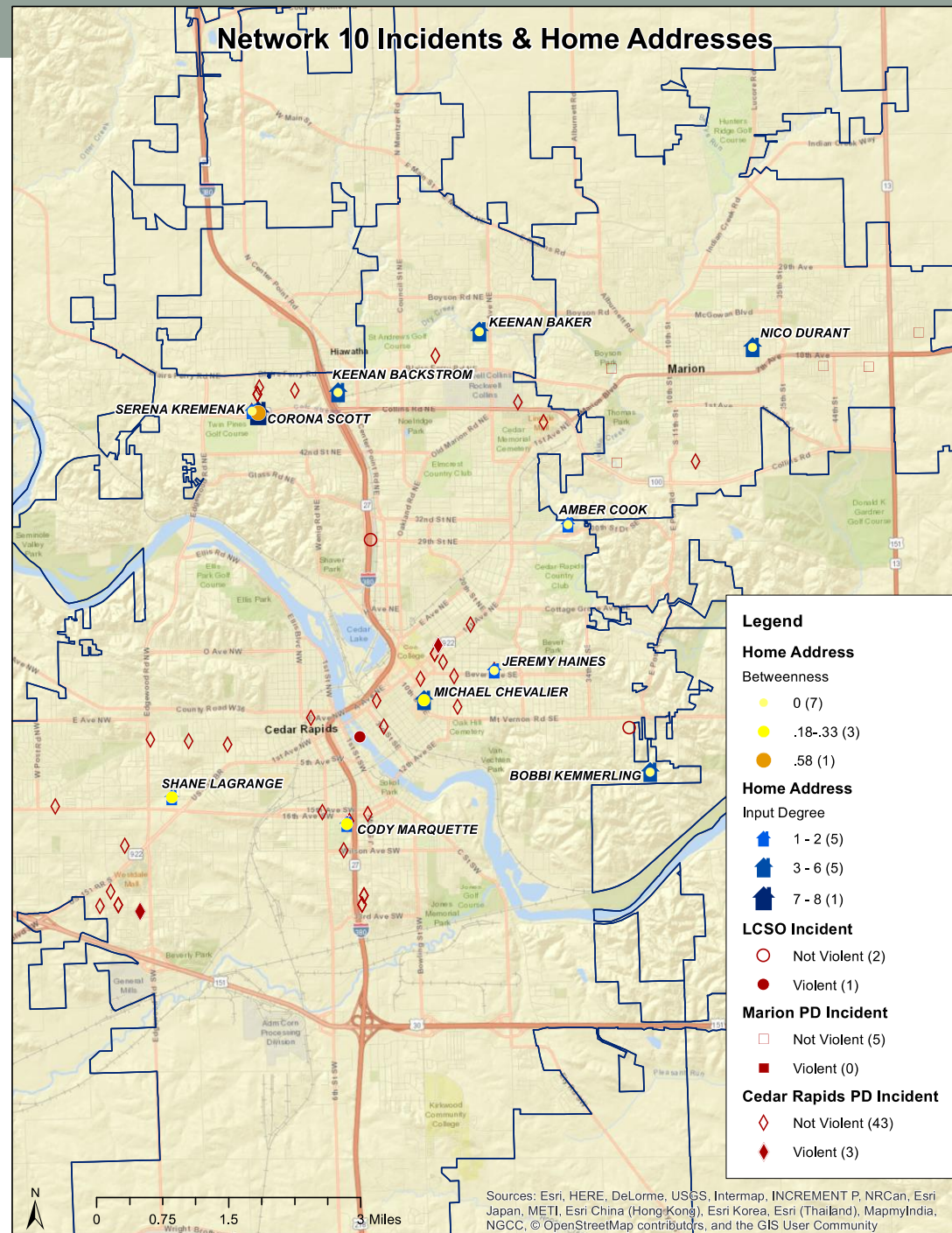
- Multi-jurisdictional
 - Cedar Rapids PD
 - Marion PD
 - Linn County SO
- Data from May 1st, 2015 through April 30th, 2017
 - All Incidents and Field Interviews
 - Home Addresses
- Analysis
 - Two mode network connecting people through incidents
 - Mapping of incidents and home locations

Linn County: Social Network Analysis

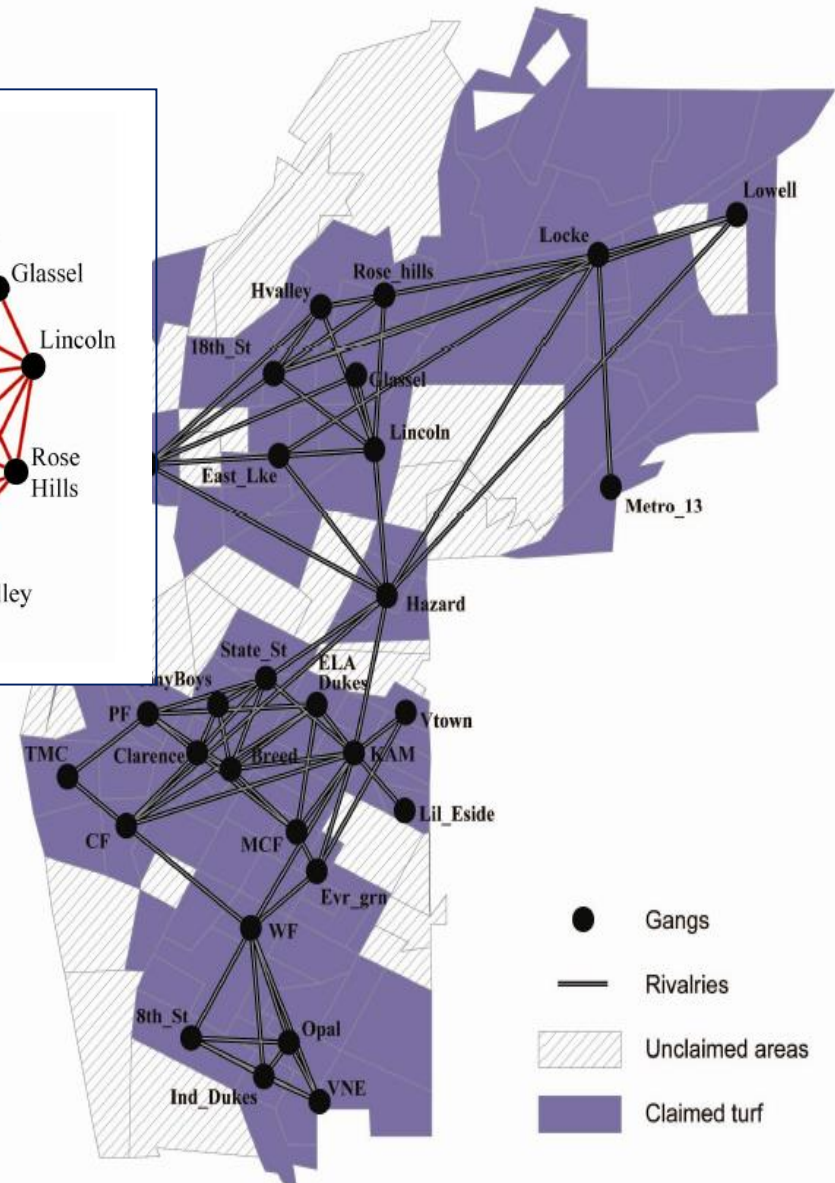
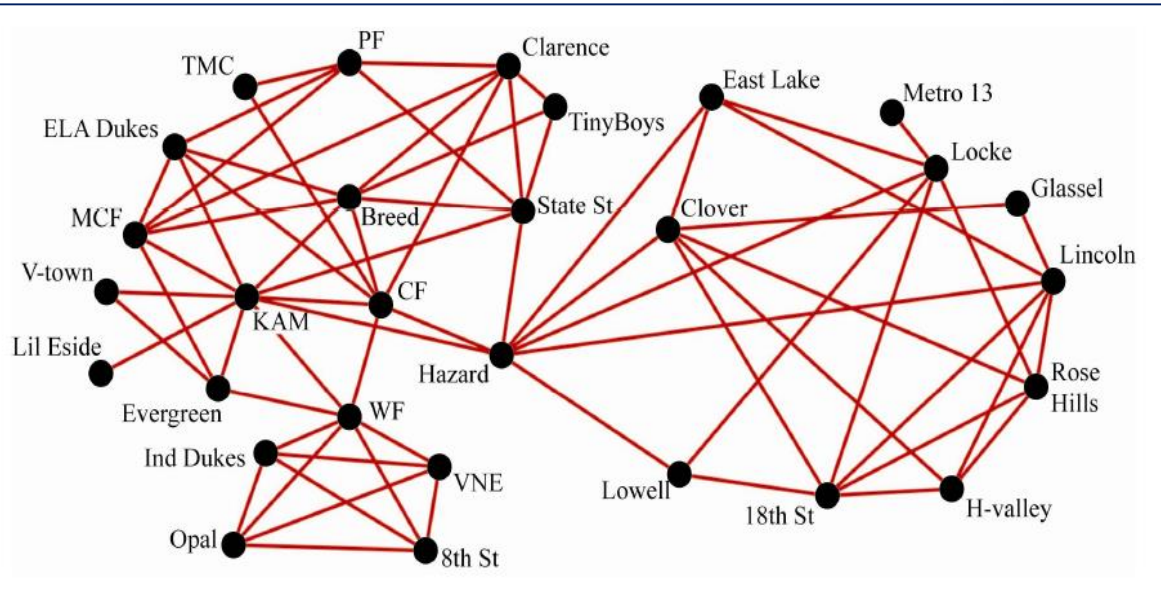
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Linn County: SNA on a Map



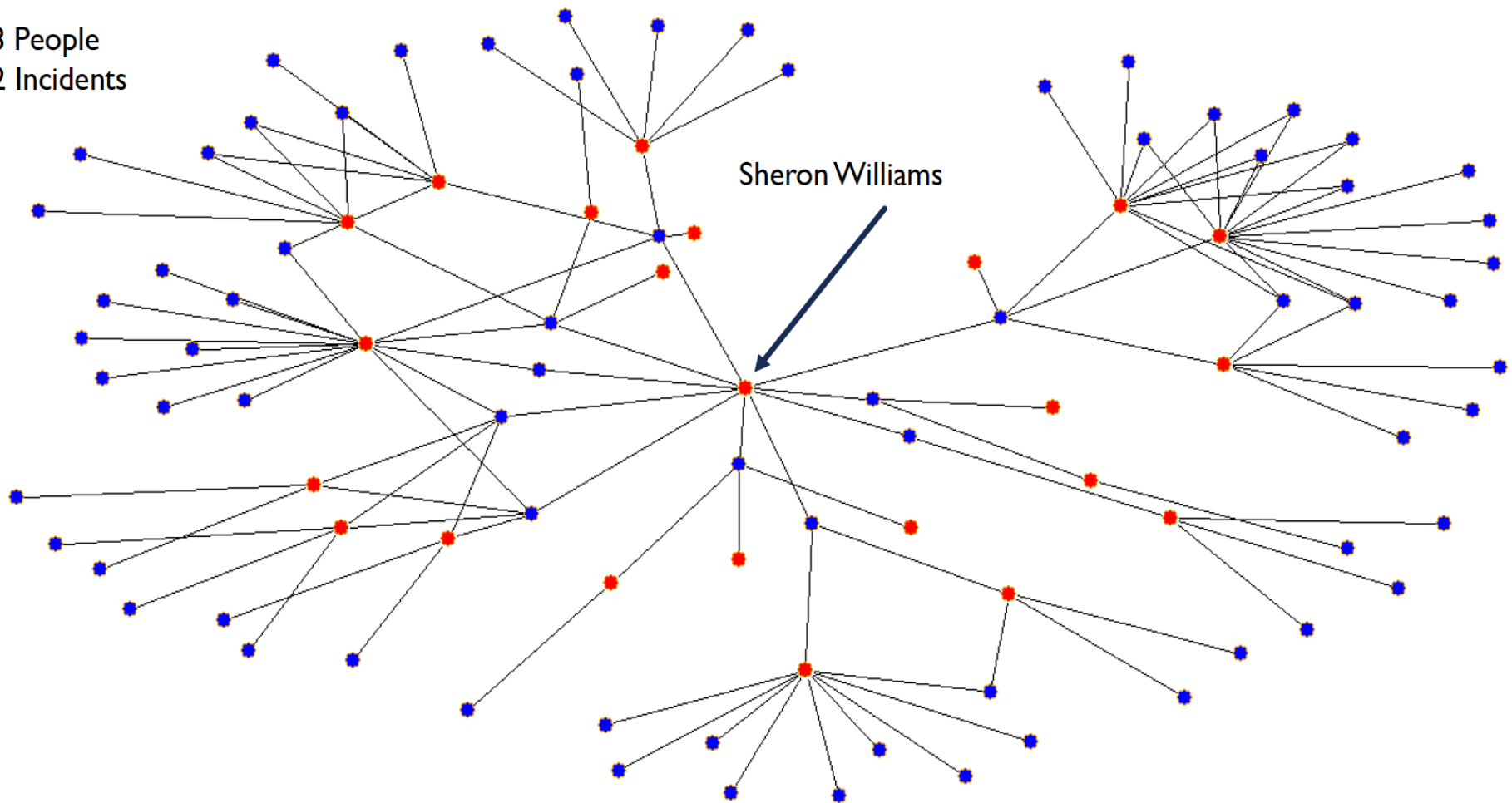
Another Example...LA Gangs



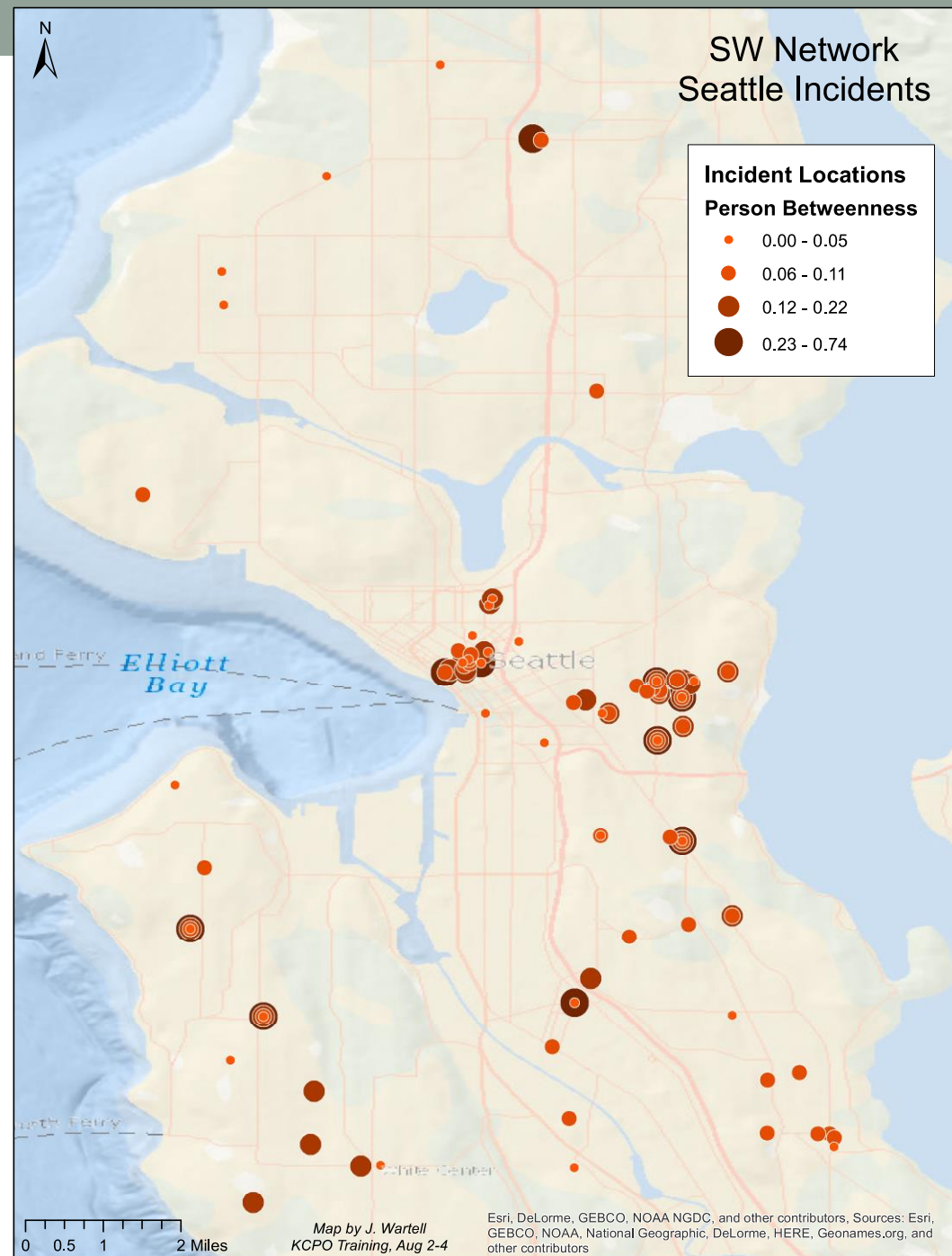
“Spatializing Social Networks: Making Space for Theory in Spatial Analysis”
Dissertation by Steven Radil

KING COUNTY EXAMPLE

23 People
72 Incidents



GIS MAP OF SW NETWORK – SEATTLE



EXAMINING CLUSTERS

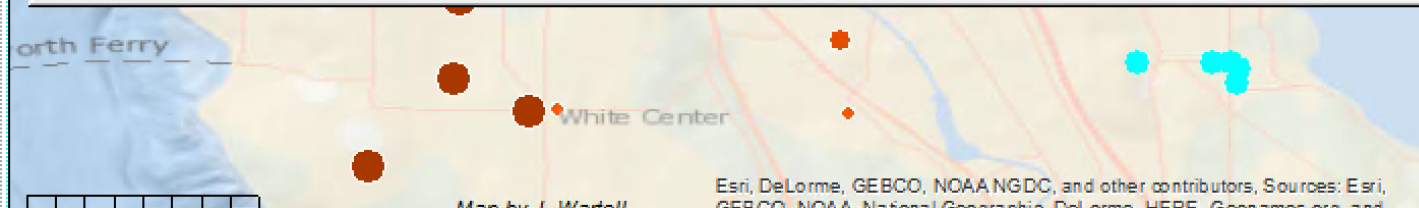


Incident Locations

	IncNum	Label	Mode	Degree	Between	Crimetype	Involvemen	IncLocatio
	2016423757	MAKALYA_WOODS_2002	2	11	0.111149	ASSLT-NONAGG	JUV - SUSPE	S HENDERSON ST & RAINIER AV S
	2016115886	VERONICA_LOPEZ-BARAJAS_2001	2	7	0.082487	ASSLT-NONAGG	JUV - ARRES	4800 S HENDERSON ST
	2016116236	VERONICA_LOPEZ-BARAJAS_2001	2	7	0.082487	THEFT-SHOPLIFT	JUV-SUBJECT	9000 RAINIER AV S
	2016116299	VERONICA_LOPEZ-BARAJAS_2001	2	7	0.082487	WARRARR-MISDEMEANOR	JUV - ARRES	9000 RAINIER AV S
	2016115886	RUQAYYAH_PARKER_2001	2	6	0.069915	ASSLT-NONAGG	JUV - ARRES	4800 S HENDERSON ST
	2016203046	RUQAYYAH_PARKER_2001	2	6	0.069915	DISTURBANCE-OTH	JUV-SUBJECT	8825 M L KING JR WY S
	2016116236	RUQAYYAH_PARKER_2001	2	6	0.069915	THEFT-SHOPLIFT	JUV - SUSPE	9000 RAINIER AV S
	201634614	RUQAYYAH_PARKER_2001	2	6	0.069915	THEFT-SHOPLIFT	JUV - ARRES	9000 RAINIER AV S
	201788750	BRADLEY_PETERSON_1978	2	2	0.021277	DISTURBANCE-OTH	SUBJECT	9200 BLOCK RAINIER AV S

◀ ▶ 0 ▶ ▶ | (9 out of 143 Selected)

Incident Locations



Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National Geographic, DeLorme, HERE, Geonames.org, and

EXAMINING CLUSTERS

Table

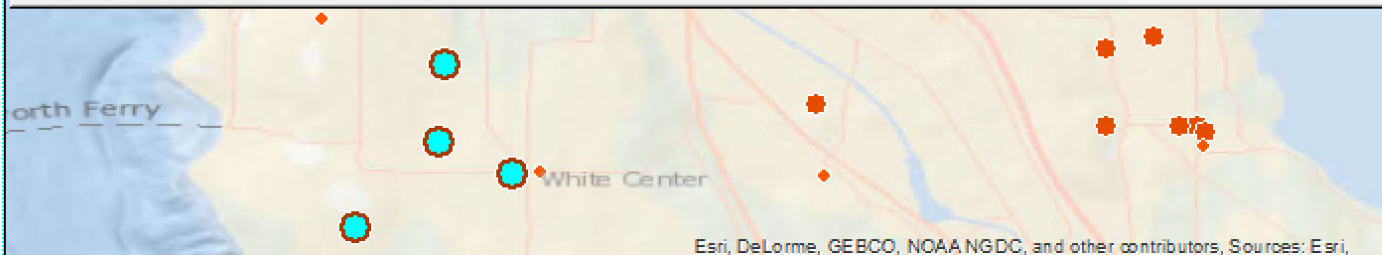


Incident Locations

	IncNum	Label	Mode	Degree	Between	Crimetype	Involvement	IncLocatio
	201634567	HANNA_KIDANE_2002	2	14	0.219206	THEFT-BUILDING	JUV - SUSPE	10247 36 AV SW
	2016100908	HANNA_KIDANE_2002	2	14	0.219206	WARRARR-FELONY	JUV - ARRES	10247 36 AV SW
	201761791	HANNA_KIDANE_2002	2	14	0.219206	WARRARR-FELONY	JUV - ARRES	16 AV SW & SW ROXBURY ST
	2016327251	HANNA_KIDANE_2002	2	14	0.219206	THEFT-SHOPLIFT	JUV - ARRES	2600 SW BARTON ST
	2016148241	HANNA_KIDANE_2002	2	14	0.219206	WARRARR-MISDEMEANOR	JUV - ARRES	2600 SW BARTON ST
	2015437833	HANNA_KIDANE_2002	2	14	0.219206	THREATS-OTHER	JUV - SUSPE	2601 SW KENYON ST
	2016154747	HANNA_KIDANE_2002	2	14	0.219206	DISTURBANCE-OTH	JUV-SUBJECT	2601 SW KENYON ST

0 (7 out of 143 Selected)

Incident Locations



Once the Network is Mapped

Things to consider...

- How many incidents in each jurisdiction?
- How many people in each jurisdiction?
- How many different addresses in each?
- What does the clustering look like?
- Do the people with the strongest connections have close or further away locations?

LET'S DO THIS!

Step by Step Guide to Combining SNA with GIS

DATA

- Network nodes (people and incidents)
 - Unique identifier
 - Network number
 - Betweenness score
 - Centrality score
- Incidents/Crimes, Arrests, Field Interviews
 - MINIMUM
 - Unique identifier
 - Addresses
 - Location of Incident, Arrest, FI
 - Home(s)
 - OTHER THAT YOU MAY WANT TO CONSIDER
 - Crime Type/Charge/Group (eg. Violent, gun-related, etc.)
 - Incarceration Status
 - Parole/Probation Status
 - Outstanding Warrants

PREPPING YOUR DATA

Make sure...

- ✓ Dupes are deleted
- ✓ Addresses are geocoded (if you have x,y already, bonus!)
- ✓ Unique identifiers match (*beware of dupes from differing agencies – create new if needed!)
- ✓ There is a field that designates (may need to create!) whether address is home, crime, or arrest
- ✓ Crime charges/groups are consistent
- ✓ Any additional data/fields are consistent

PREPPING YOUR DATA, PART 2

Combining/Linking Data

- Combine multiple jurisdictions (*already done for this class)
 - Just the fields you will use, for keeping it simple
- Add incident address field(s) to network output table for incident (using VLookUp works well)
- For addresses associated with people, you will need to link tables to determine all addresses the person may be associated with (Access works well for this “one to many”)
 - Import your address data table
 - Import your network data table with the person label
 - Link on Network label to address table
 - Export linked table(s) back out to Excel

LET'S MAP!

- Add table(s) to ArcMap
- Convert to shapefile
- Add appropriate base layers (after downloading shp files - <http://www5.kingcounty.gov/gisdataportal/>)
 - Streets (“Street Address”)
 - Jurisdictional boundaries (“Cities and Unincorporated King County”)
 - Schools, Parks, Water features to give context
 - Other relevant data for your jurisdiction
 - Transit stations/stops
 - Gang territories
 - Patrol district/beat boundaries

MAKING THE MAP USEFUL

- Symbolizing your data
 - Creating graduated symbols
 - Choosing a color and size scheme
- Cartographic Elements
 - Title
 - Legend
 - Scale Bar
 - North Arrow
 - Date/Source