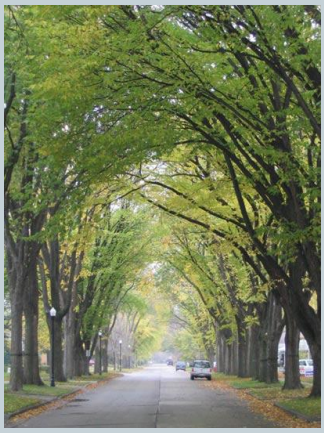
Spread of Dutch Elm Disease in Ladd's Addition Portland, Oregon



BY JUAN GONZALES,
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Research Question

- Where are the Dutch Elm Disease hotspots in Portland, Oregon?
- Which trees in Ladd's Addition are most at risk for DED?

Dutch Elm Disease

- Caused by fungal pathogens
- Spreads easily, primarily through elm bark beetles, but also through root grafts and human activity
- Affects primarily American Elms
- Results in tree death

DED in Portland

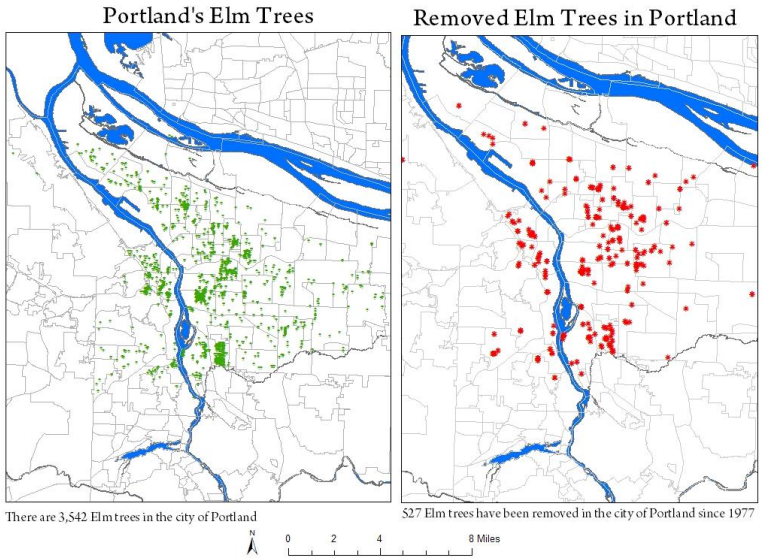
- City of Portland began monitoring the city's more than 3500 elms in 1986
- Involves seasonal inspection of trees, twig analysis, rapid removal of sick or dead elms, proper disposal of sick elms, inoculation, and community education
- Save Our Elms is also working in several Portland neighborhoods to preserve street trees
- Urban Forestry Commission and Eastmoreland Tree Association are also working with this disease

Why Study Dutch Elm Disease?

- Trees important to ecosystem
- Urban Canopy
- Livability of neighborhoods

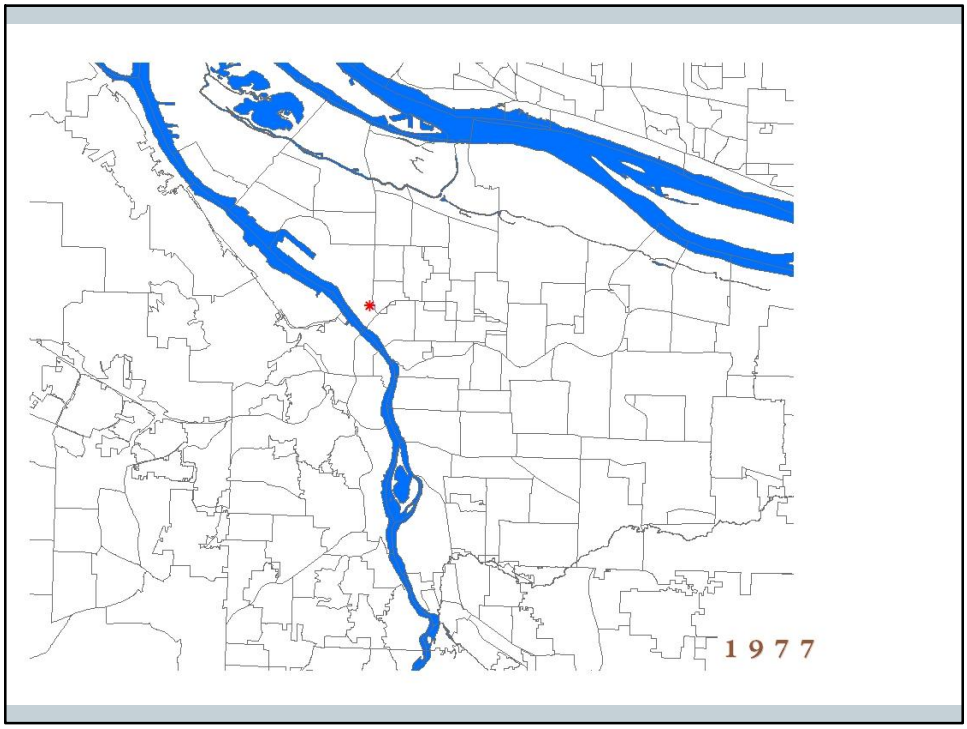
Data Sources

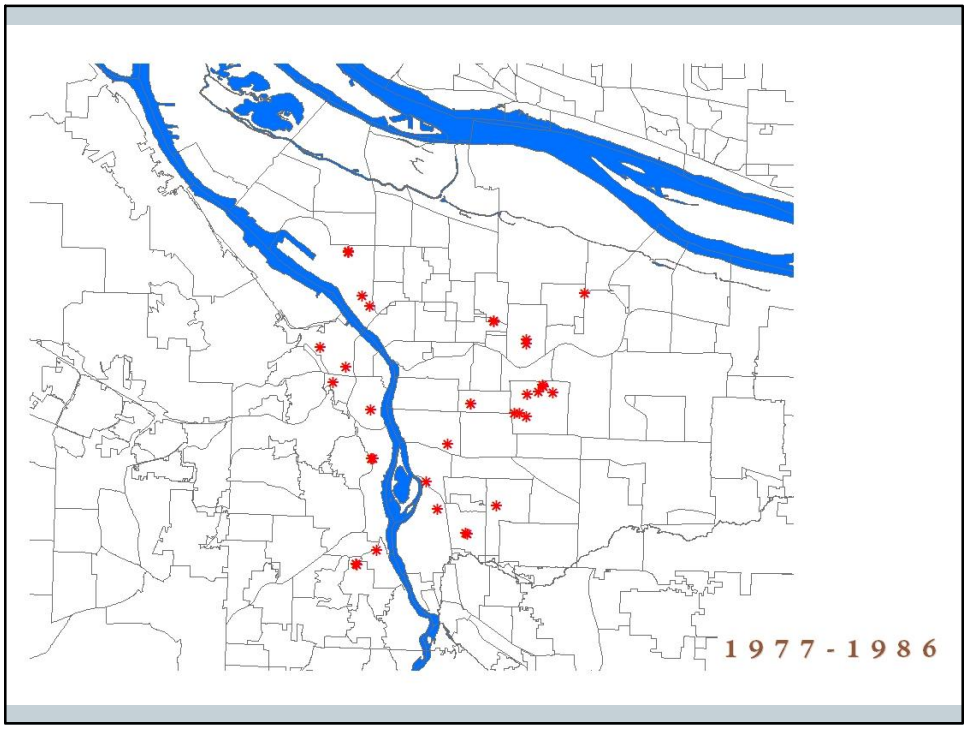
- RLIS
  - Tax lots
  - Road Network
- City of Portland
  - Elm tree data
- Save Our Elms
  - Ladd's Addition Elm data
  - Pruning Initiative
  - Inoculation Cycle Records

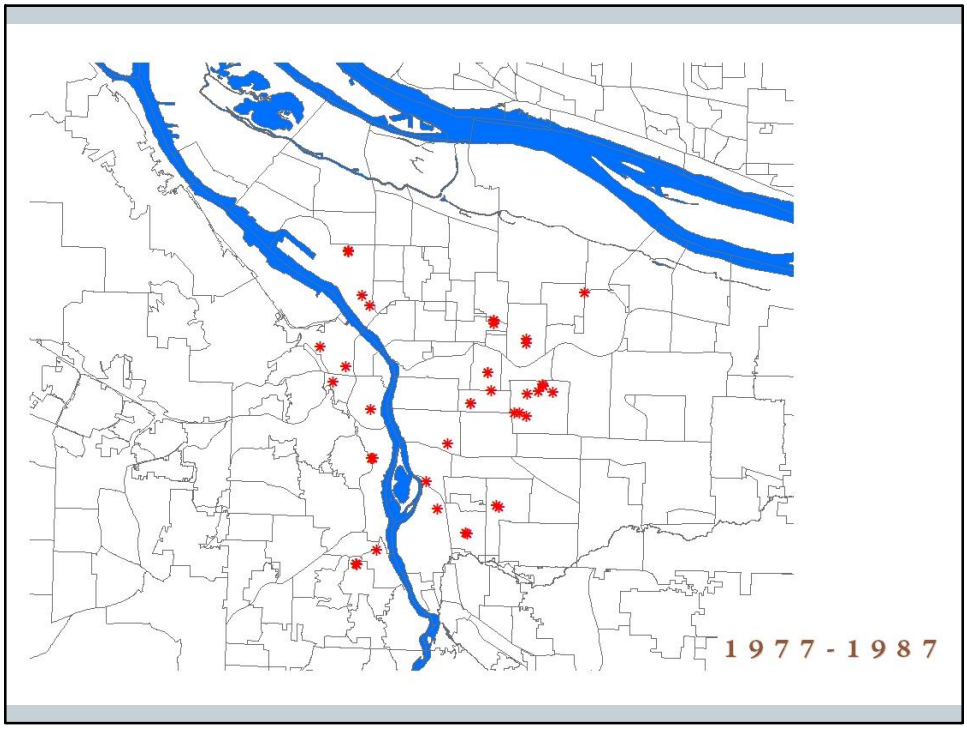


American Elms that have been removed since 1977 due to Dutch Elm Disease

- Identify spatial patterns
- Recognize hotspot of DED in Portland
- Visualize physical factors that might explain the patterns


1977


1977-1986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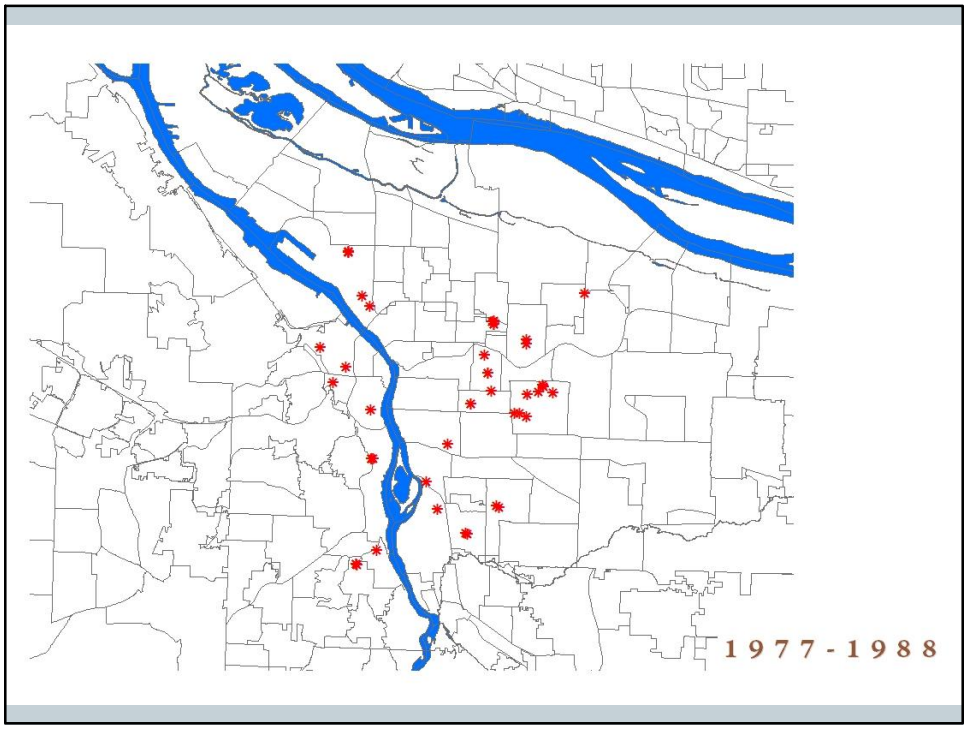
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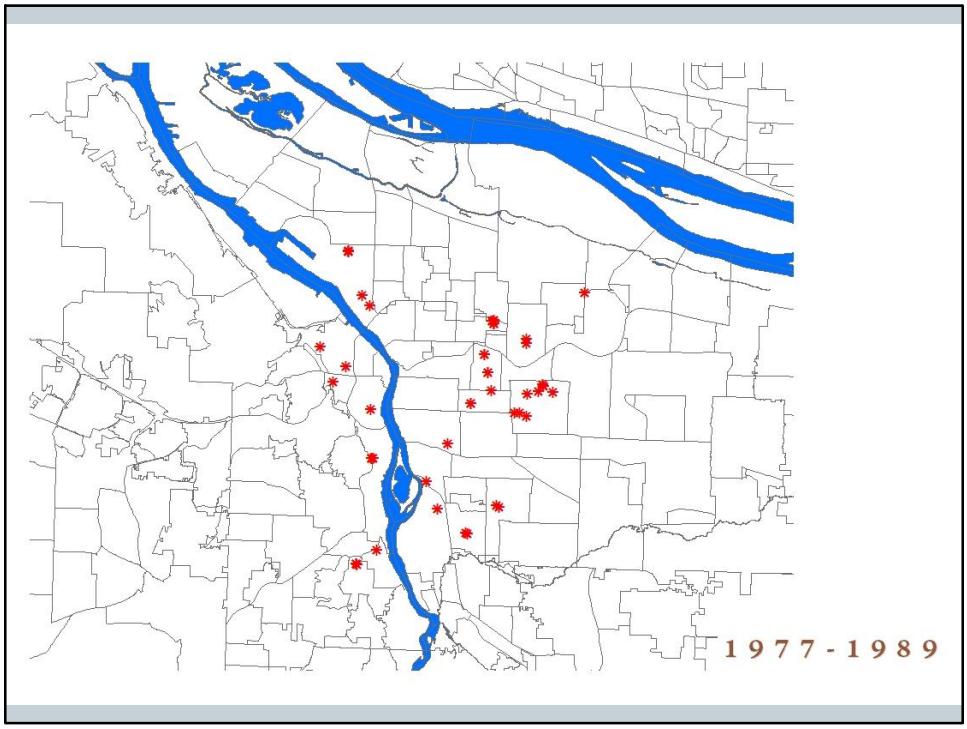
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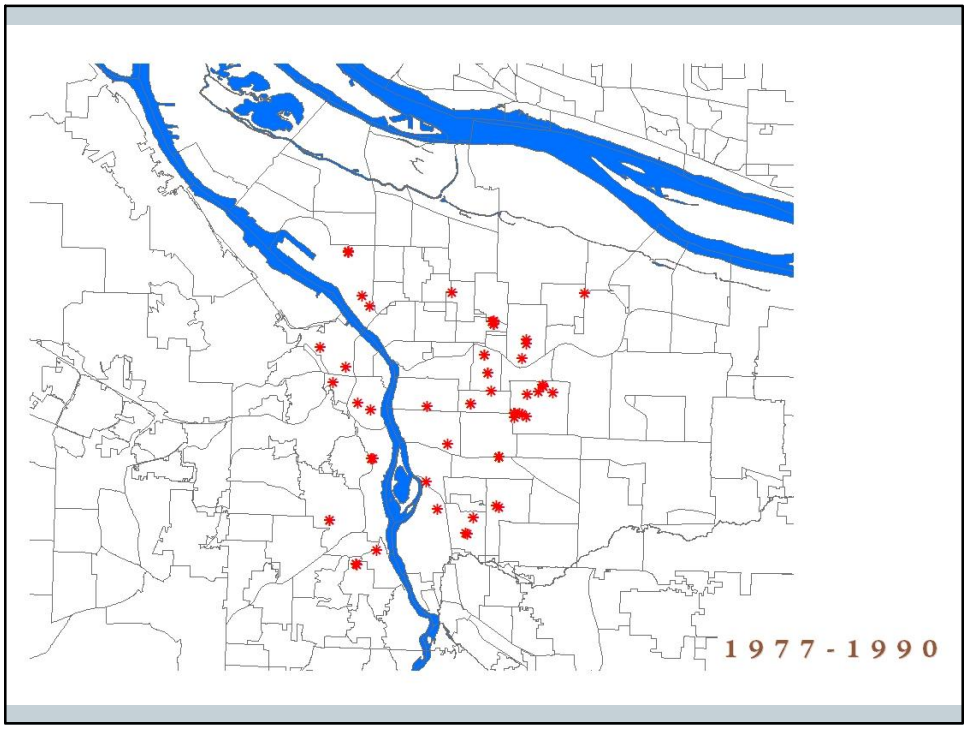
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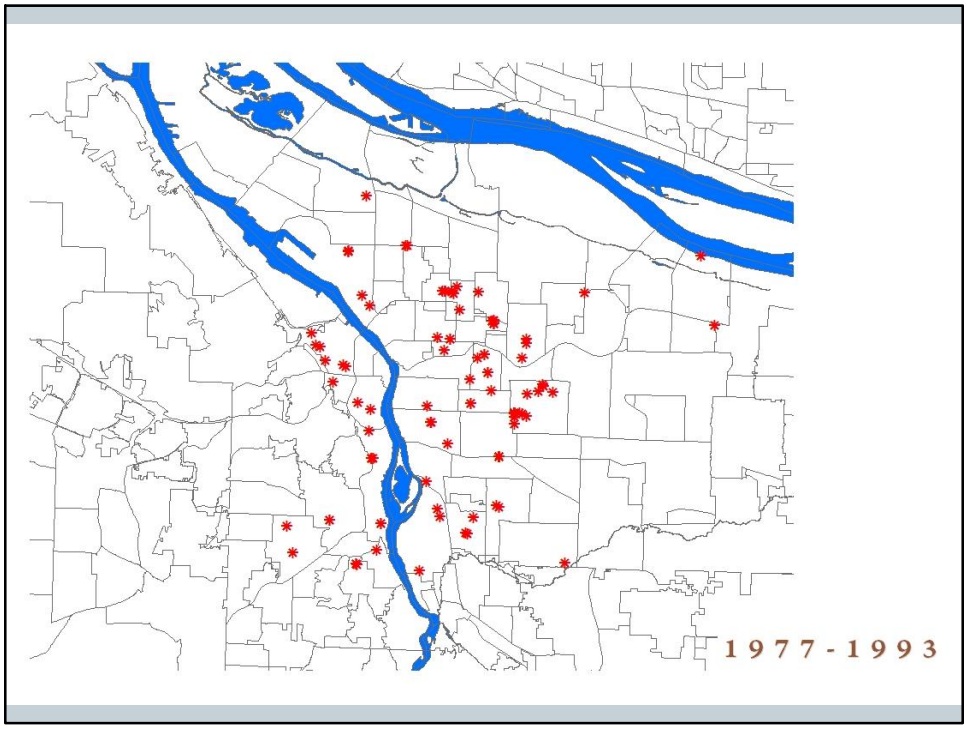
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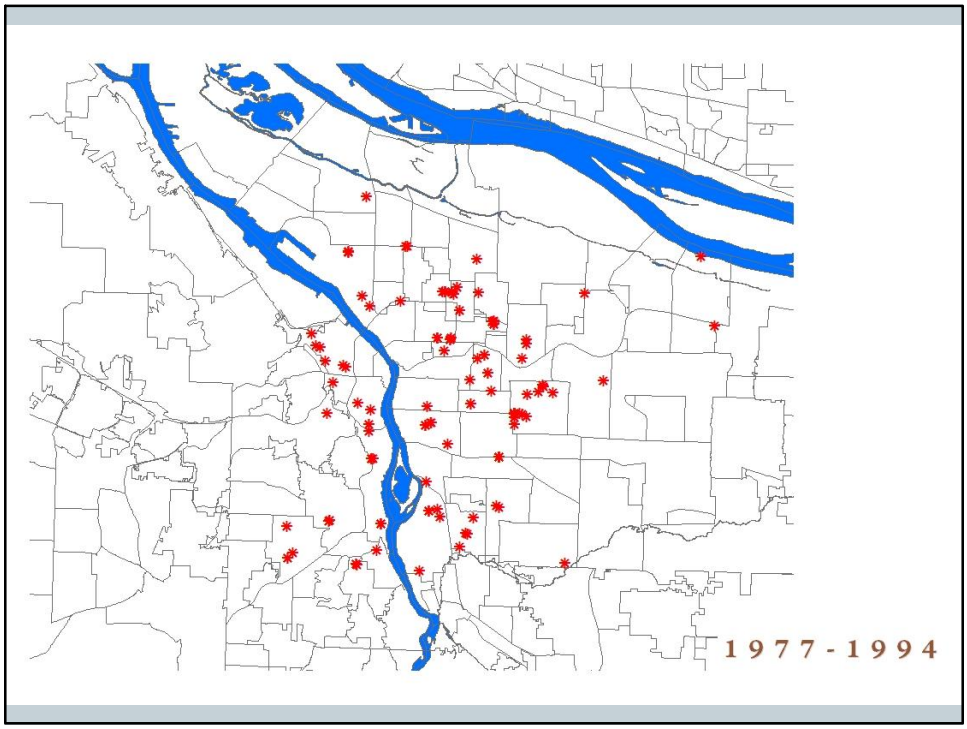
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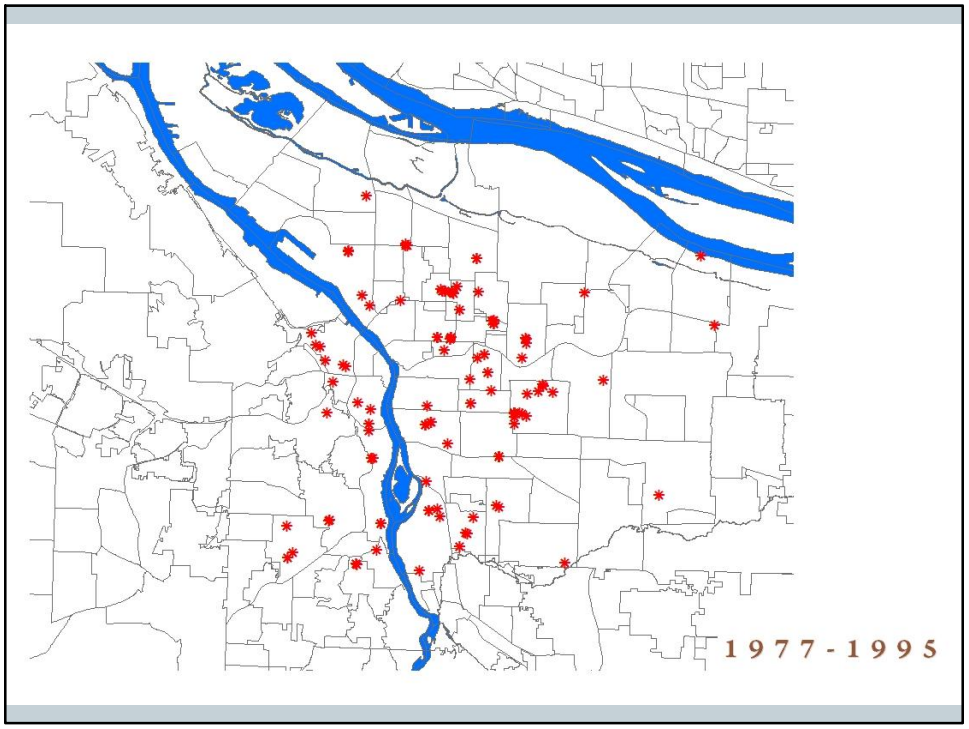
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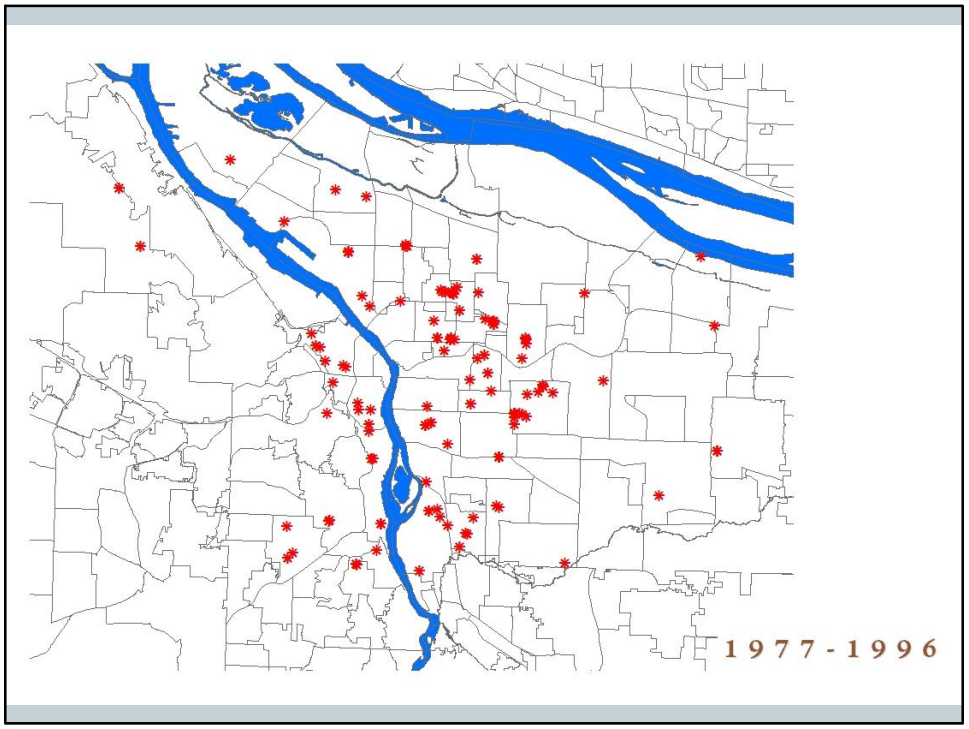
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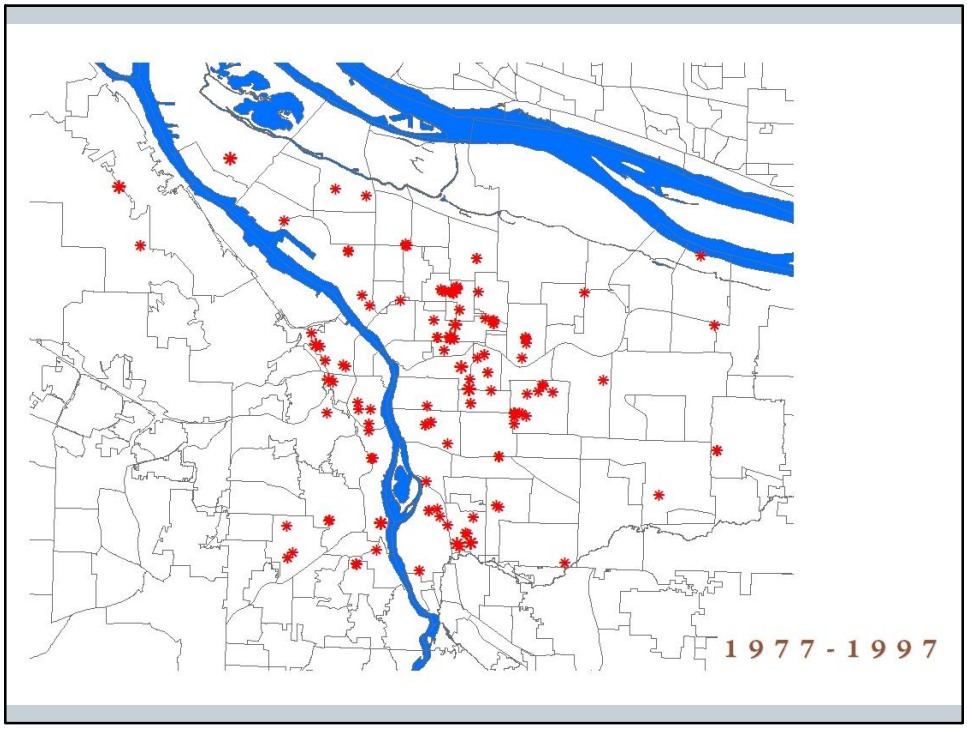
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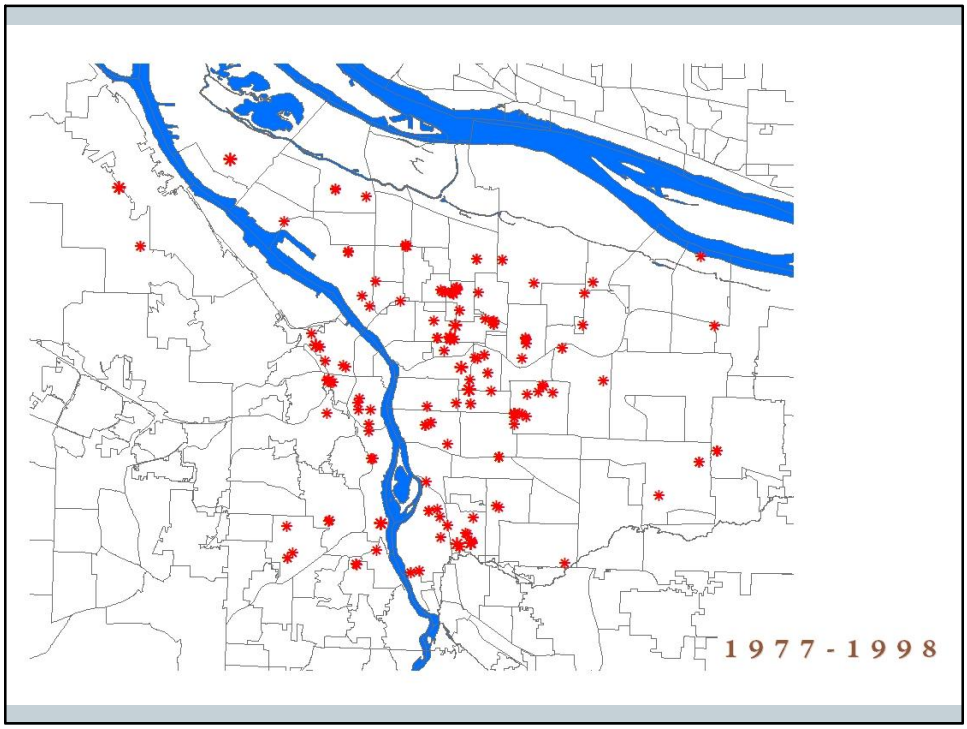
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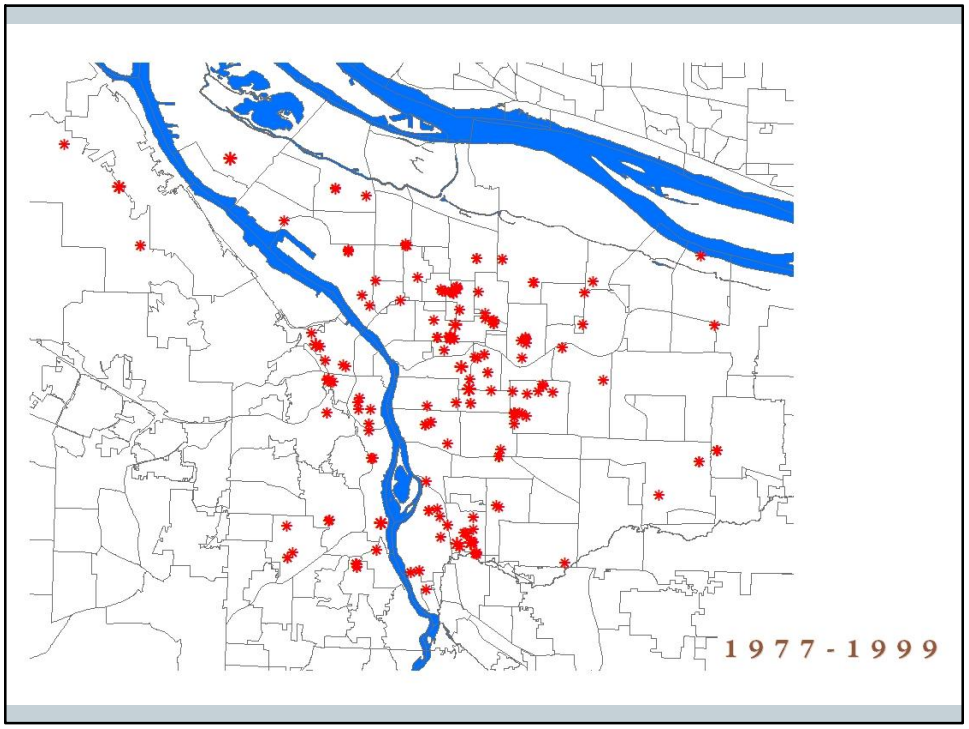
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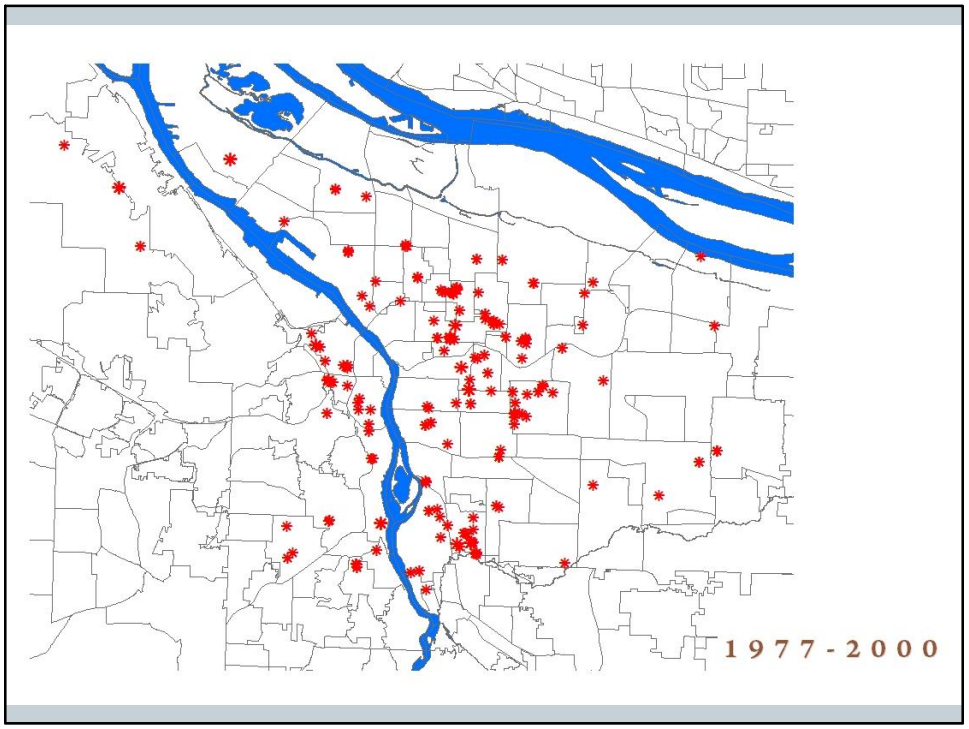
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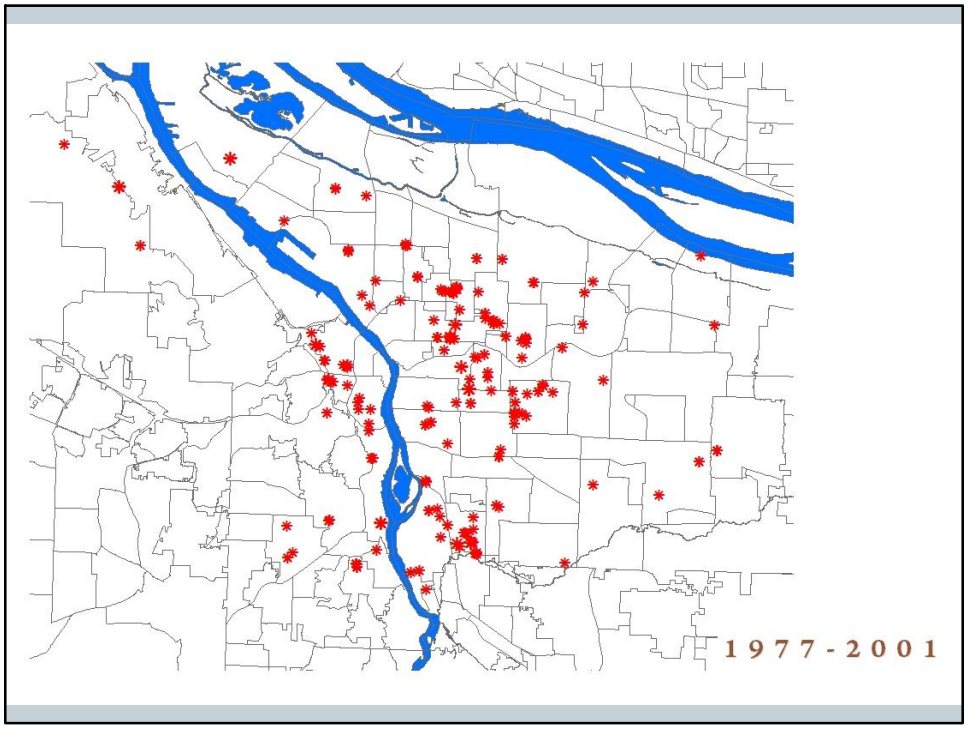
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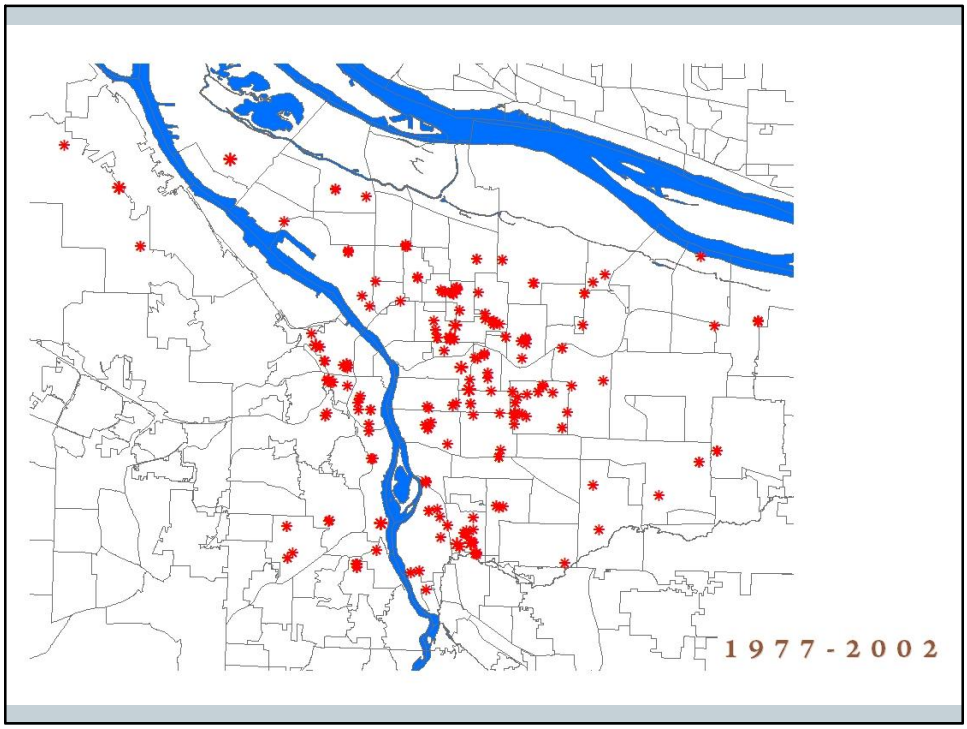
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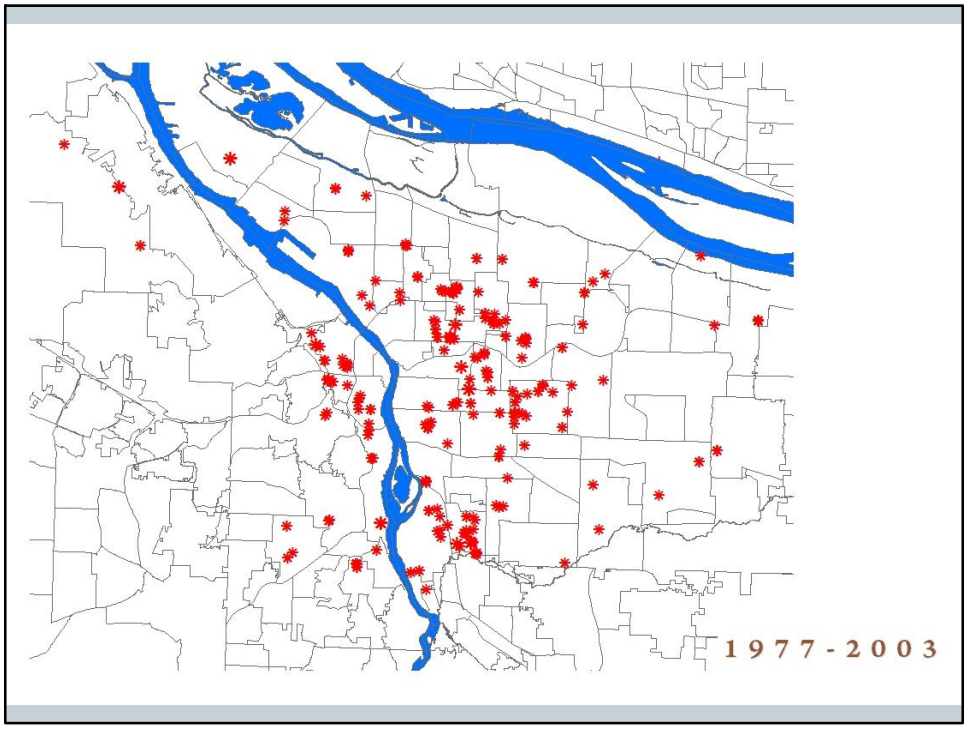
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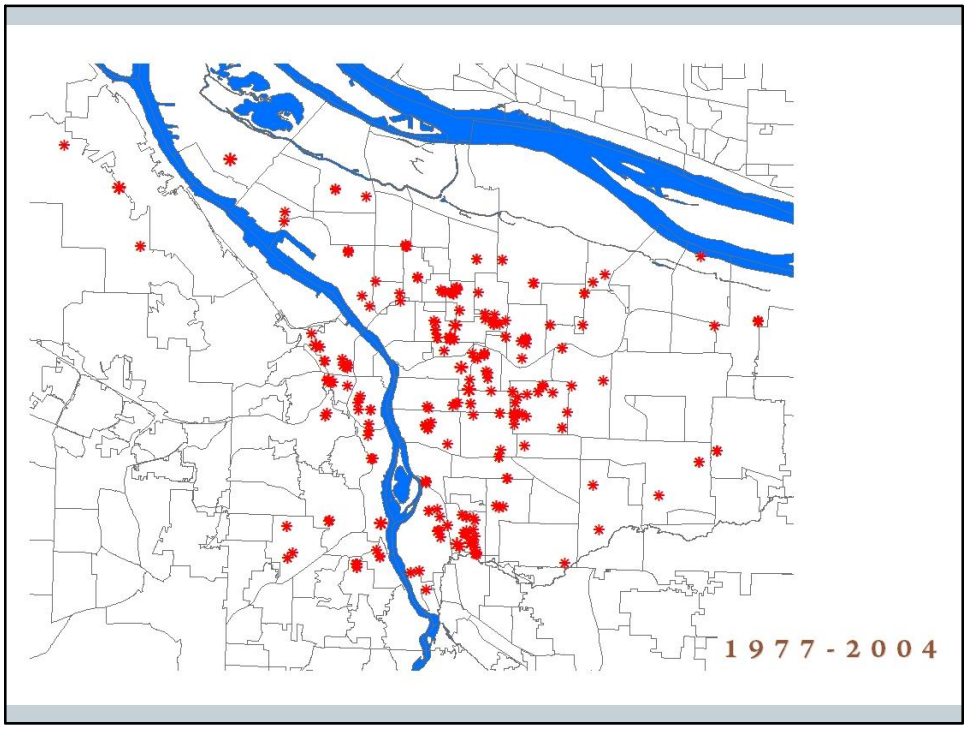
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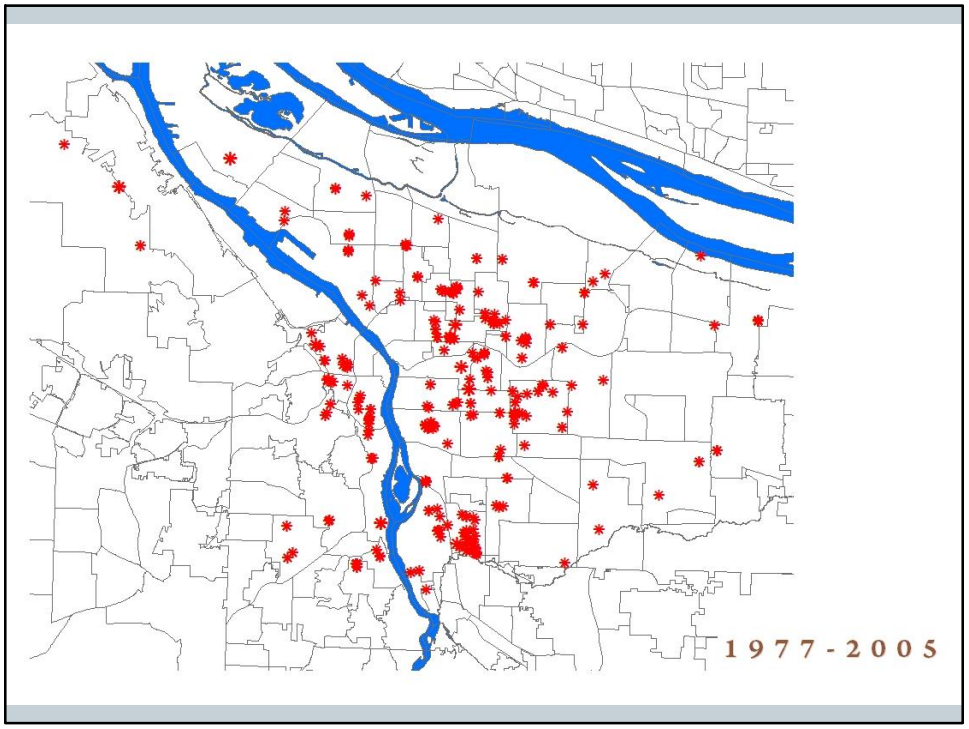
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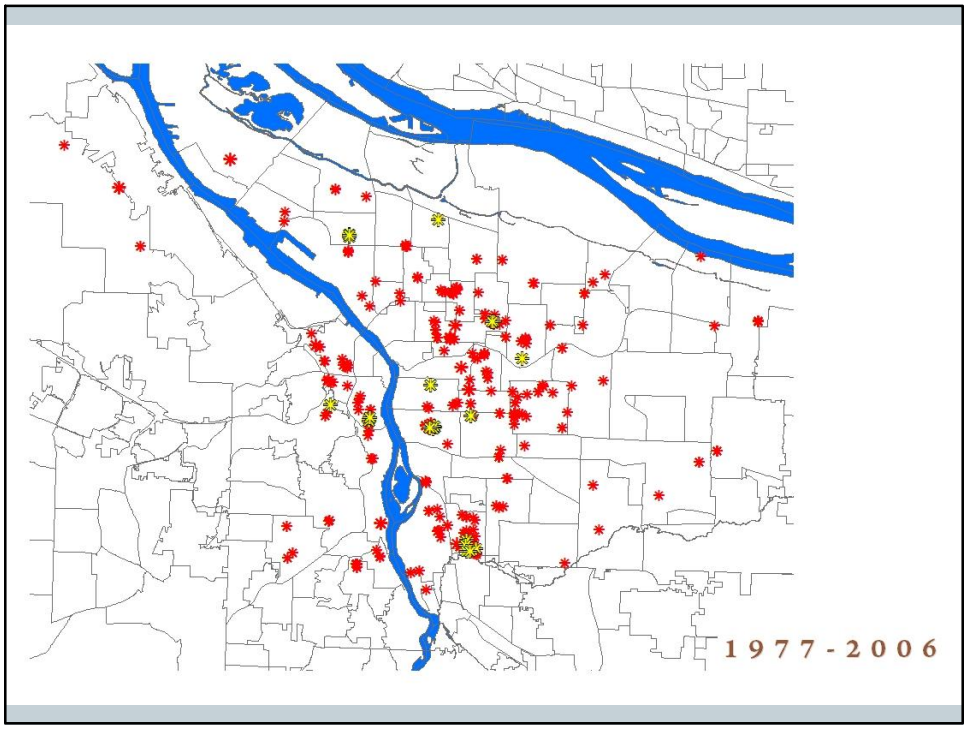
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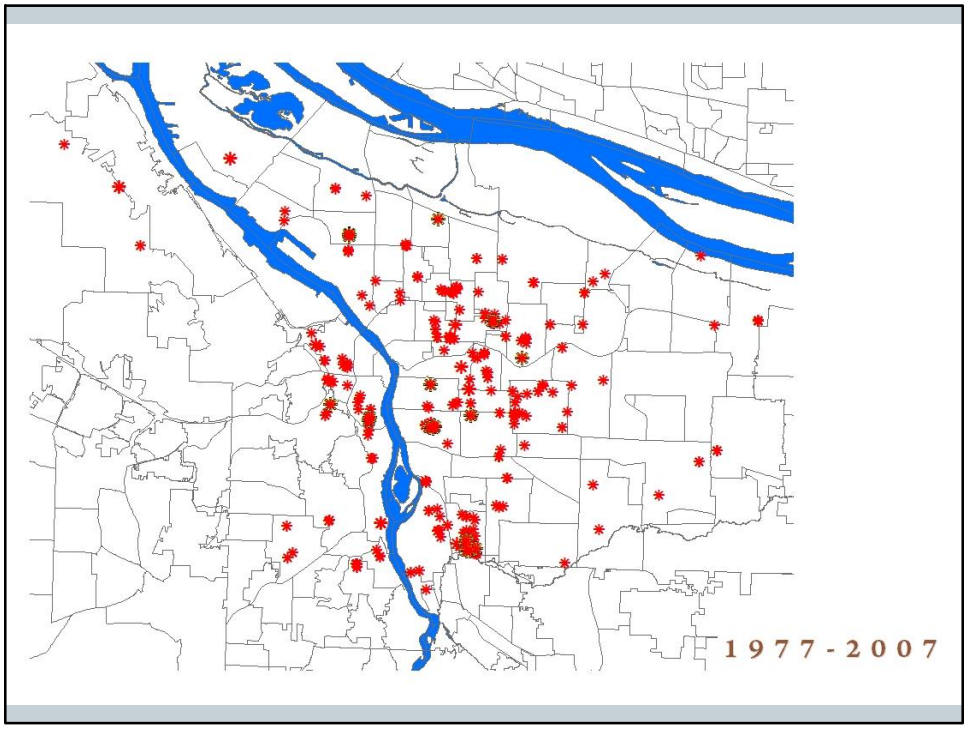
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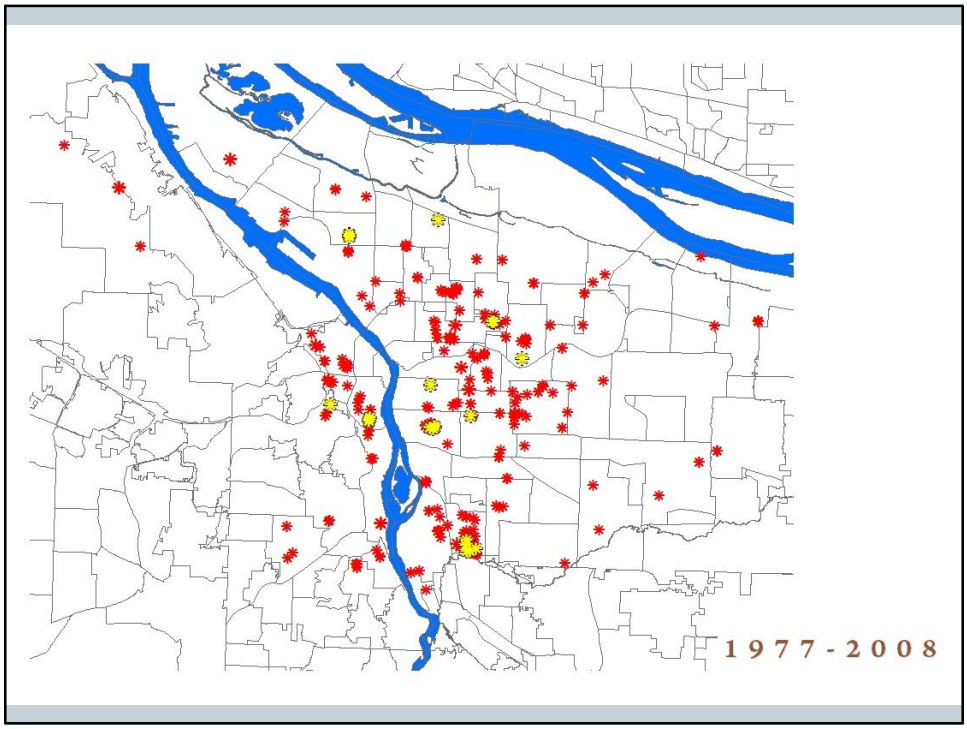
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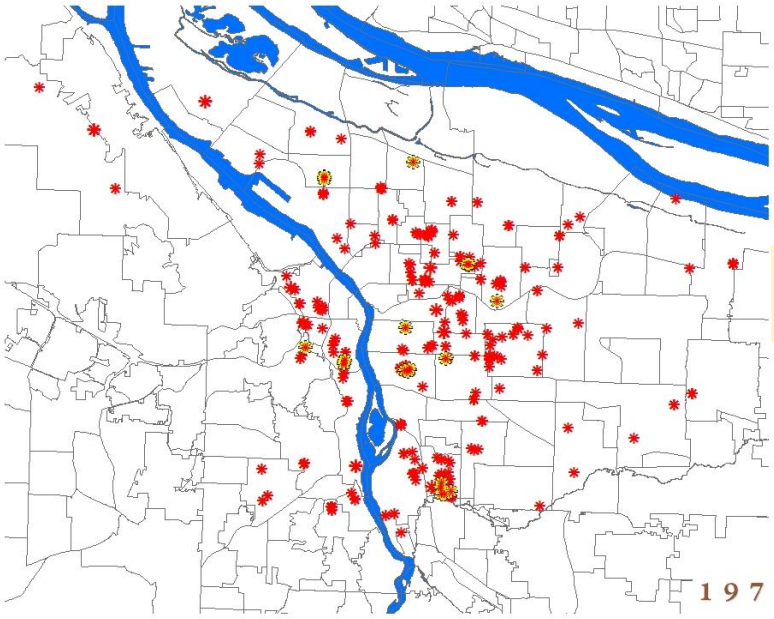
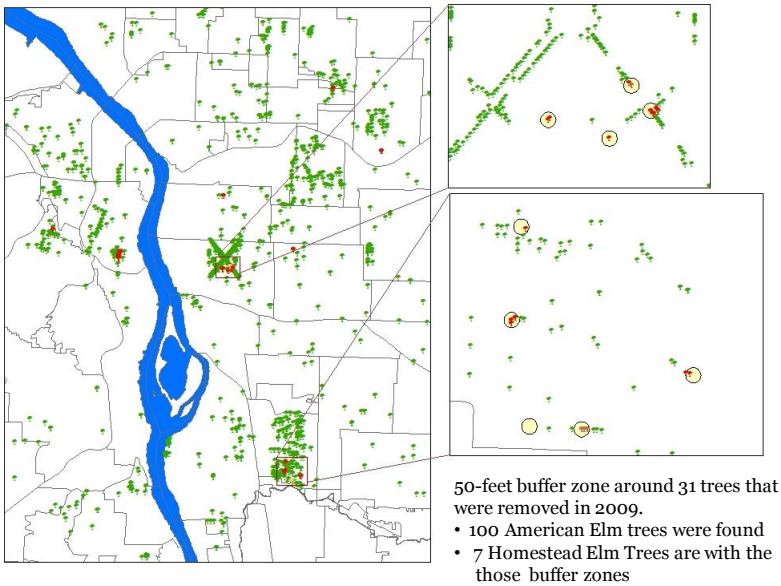
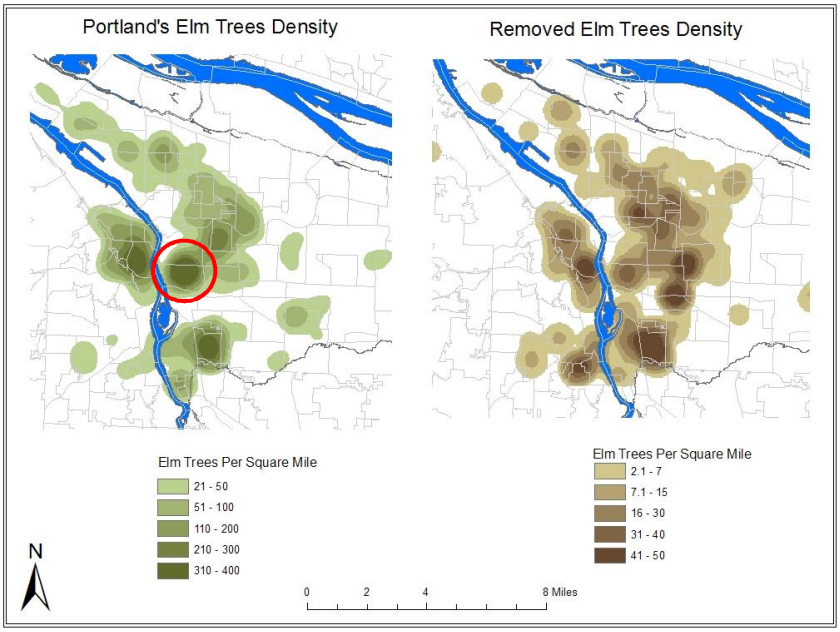


Two Vectors of DED
•Elm Bark Beetle
•Root Crafting



50-feet buffer zone around 31 trees that were removed in 2009.
- 100 American Elm trees were found
- 7 Homestead Elm Trees are with the those buffer zones



Data Manipulation:

Excel - Spreadsheets (from Save Our Elms):
INVENTORY + PRUNING + INOCULATION
- correlate, correct and combine all records into one table
- add REMOVAL field (from Final Report)
- add FID field for "Join" with Attribute table

Arcmap – shapefiles (from Portland Parks and RLIS):
ELMS + STREETS + TAXLOTS
- select and export features in Ladd's Addition

Compare spreadsheet with shapefile attribute table:
- Edit / estimate existing tree locations in shapefile
- Correct / eliminate incorrect tree / address pairs
- Eliminate all non-matching records (based on Table)
- Add missing trees to shapefile (based on Table)

"Join" spreadsheet to 'Ladd Elms' shapefile

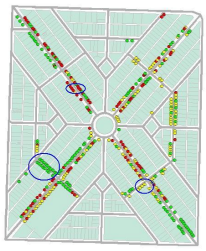
Attribute Table:

Attributes of Elms_Ladd

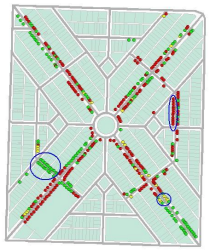
FID	REM	INOC	PRUN	TD	SP	Address	Di
213	1	0	0	0	a	2205 Ladd	
218	1	0	0	0	a	1704 Lavender	
254	1	0	0	0	a	2229 Orange	
316	1	0	0	0	a	2145 Ladd	
0	0	3	3	11	h	2036 Larch	
1	0	3	3	8	h	2100 Larch	
2	0	1	1	46	a	2100 Larch	
3	0	1	2	27	a	2110 Larch	
4	0	1	2	22	a	2110 Larch	
5	0	1	2	24	a	2110 Larch	
6	0	3	3	2	h	1321 Birch	
7	0	3	3	14	h	1321 Birch	
8	0	3	3	6	h	1331 Birch	
9	0	3	3	2	h	1331 Birch	
10	0	3	3	11	h	1341 Birch	
11	0	3	3	6	h	1349 Birch	
12	0	3	3	10	h	1349 Birch	
13	0	1	1	8	a	1349 Birch	
14	0	1	1	7	a	1349 Birch	
15	0	1	1	8	a	1349 Birch	

Record: 0 Show: All lect

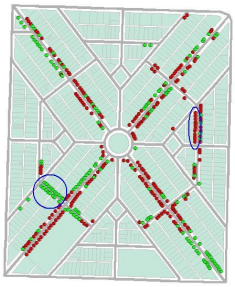
Age (Trunk Diameter):



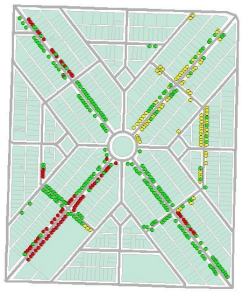
Pruning Status:



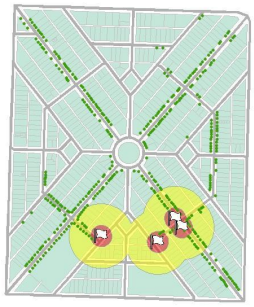
Species (American or Homestead):



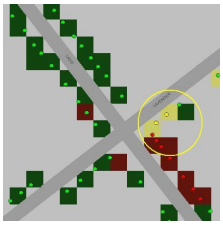
Inoculation Status:



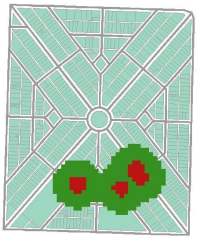
Removals (2009):



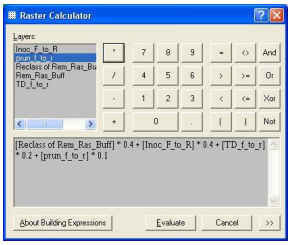
Spatial Analyst:
Convert Feature to Raster

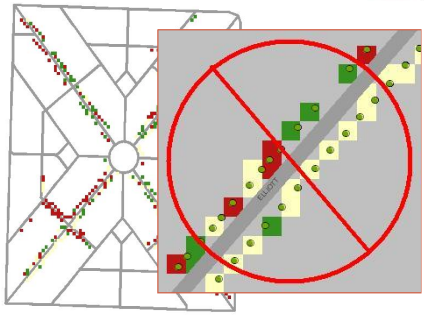


Analysis Tools:
Buffer



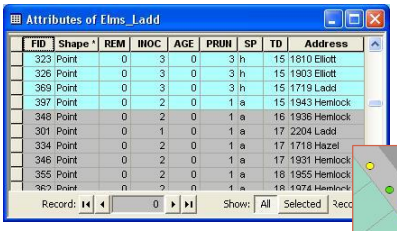
Spatial Analyst:
Raster Calculator

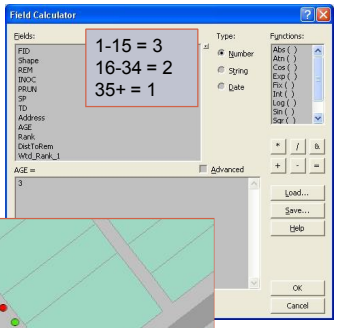




We found raster data to be inappropriate for our analysis

Use Point Data for analysis:
- add Age field to attribute table
- 'Field calculate' values based on Tree Diameter

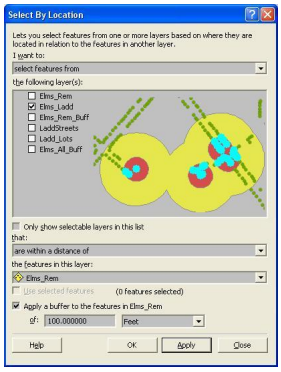




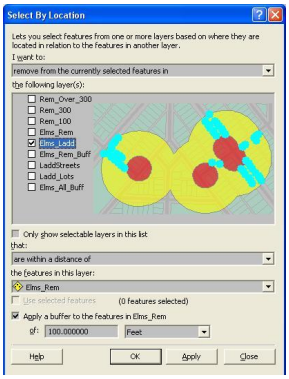
Age:

- Select by Location
- Export each selection to new shapefiles
- Assign values to 'Distance To Removal' (Field Calculator)

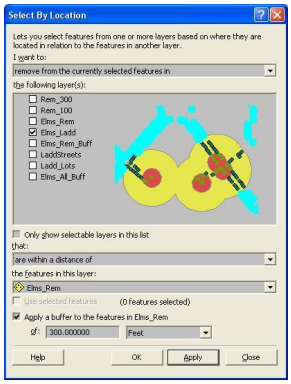
0-100



100-300



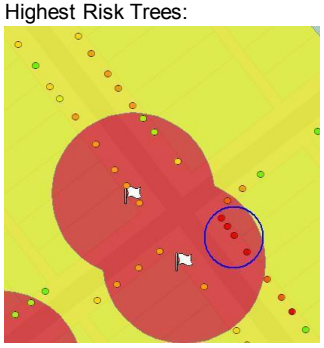
300+



-Append files into one main shapefile
- Add 'Rank' field to attribute table

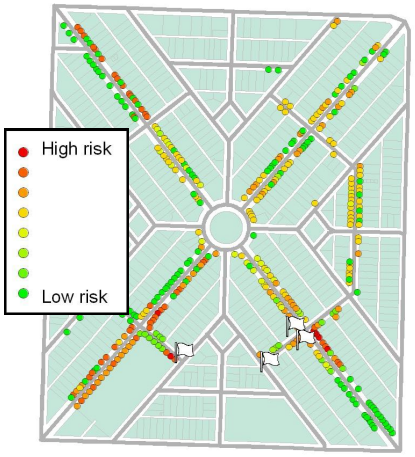
Summed Risk Factors using Field Calculator:
= (DistToR) + (Inoc) + (Age) + (Prun)

4 Highest Risk Trees:



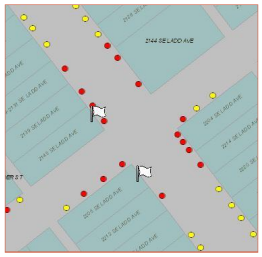
Conclusions:

Overall risk assessment:



Sum of all risk factors:

Distance To Removals only:



Symbology can be altered to highlight individual risk factors as needed:

Challenges / Limitations of project:

1) accuracy and completeness of data

2) Project planning – raster vs. vector analysis?
   - Raster analysis did not lead to useful conclusion at 'Ladd' scale

Alternative methods:

1) Assess risk by using the AHP

2) Ranks (1,2,3) can be altered as needed using field calculator and a weighted equation

This stage of the project is somewhat limited in accuracy for some trees. Data updates, refinement of methods, and additional input from the 'Save Our Elms' organization can make this a valuable tool used to monitor and prevent the spread of DED.