The Distribution of Petroleum Contamination in Florida

Analysis by Daniel Lyvers and Tracy Ryan

Purpose:

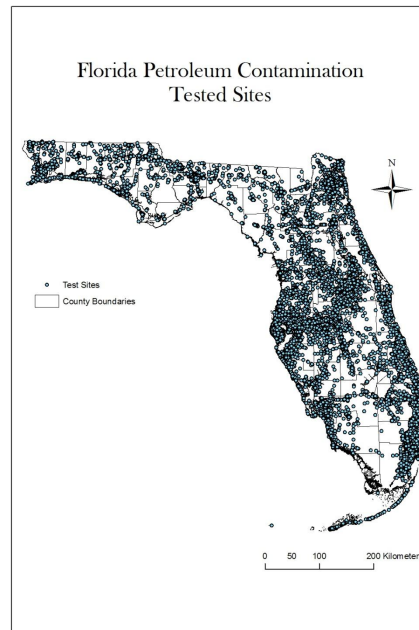▸ Explore the spatial distribution of sites with known petroleum contamination throughout Florida.

Data:

- ▶ Florida Department of Environmental Protection
  - ◦ www.dep.state.fl.us/
- ▶ Contamination Location
  - ◦ Groundwater
  - ◦ Surface Water
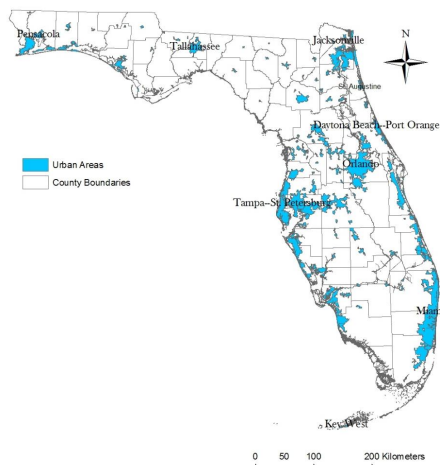 - ◦ Soil
- ▶ Status of Site

Score

- ▶ A way to measure degree of contamination.
  - ◦ Environmental setting
  - ◦ Fire / Explosion Hazard
  - ◦ Threat to drinking water
  - ◦ Potential to migrate

- ▶ Scale
  - ◦ From 1 to 250

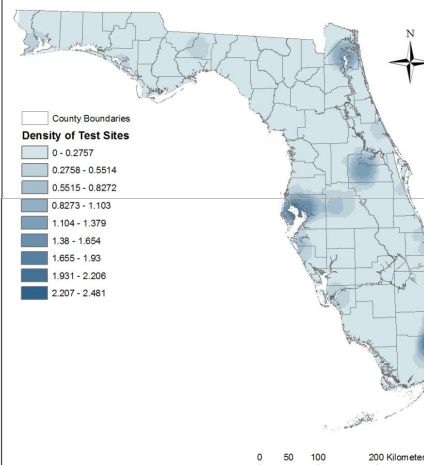 - ◦ Jeff Priddle, FDEP, Personal Communication 2010

Original Data Points

35, 000 +

Florida Petroleum Contamination
Tested Sites

○ Test Sites
County Boundaries

0 50 100   200 Kilometers

Florida Urban Areas

Pensacola
Tallahassee
Jacksonville
St. Augustine
Daytona Beach-Port Orange
Orlando
Tampa-St. Petersburg
Miami
Key West

Urban Areas
County Boundaries

0 50 100   200 Kilometers

Density of Test Points
Petroleum Study, Florida

County Boundaries
Density of Test Sites
0 - 0.2757
0.2758 - 0.5514
0.5515 - 0.8272
0.8273 - 1.103
1.104 - 1.379
1.38 - 1.654
1.655 - 1.93
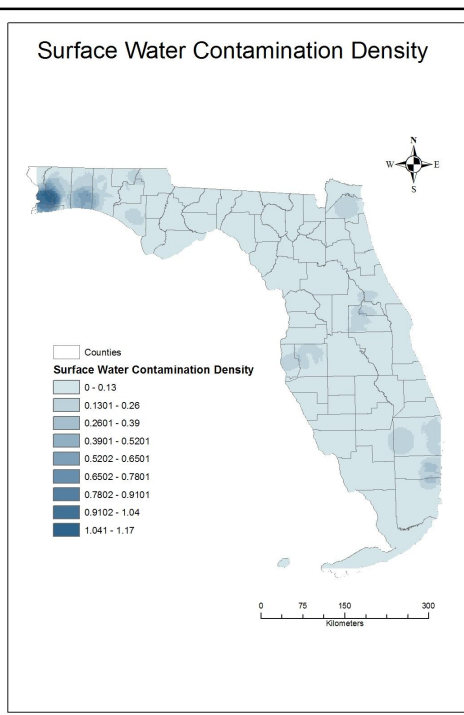1.931 - 2.206
2.207 - 2.481

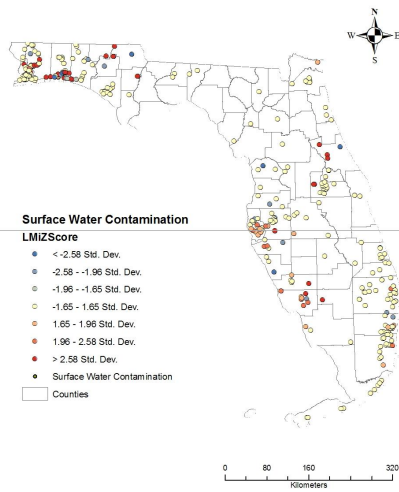0 50 100   200 Kilometers

Breaking Down the Data

▸ Divided data by location of contamination
▸ Status of site:
  ◦ Included:
    • Contamination has been verified and cleanup is needed.
    • Sites are currently being cleaned
    • Contamination has been reported
    • Application submitted for more testing on a site with known contamination.
  ◦ Excluded:
    • Cleanup completed
    • No cleanup required

Surface Water

▸ Density of contamination

Surface Water Contamination Density

Counties
Surface Water Contamination Density
☐ 0 - 0.13
☐ 0.1301 - 0.26
☐ 0.2601 - 0.39
☐ 0.3901 - 0.5201
☐ 0.5202 - 0.6501
☐ 0.6502 - 0.7801
☐ 0.7802 - 0.9101
☐ 0.9102 - 1.04
☐ 1.041 - 1.17

0   75   150   300
Kilometers
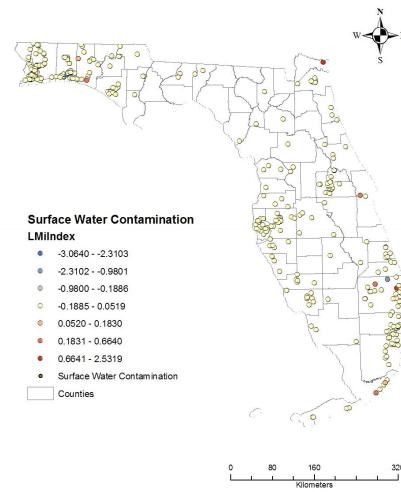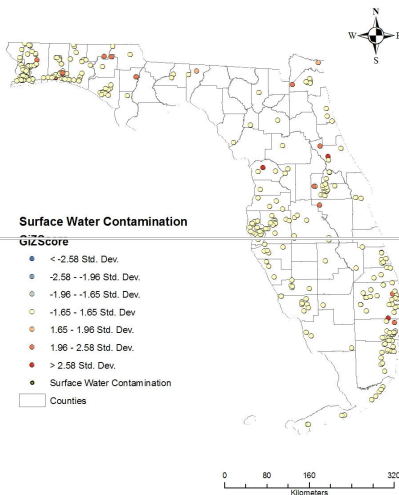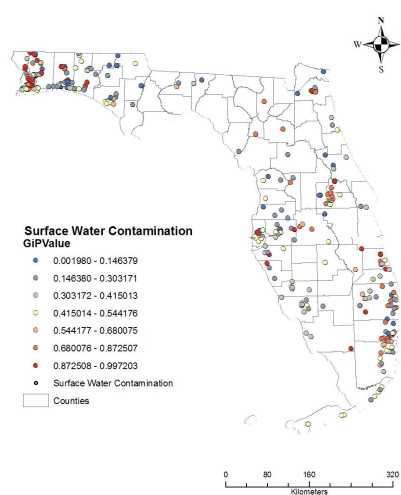
Surface Water Contamination Cluster/Outlier (Local Moran's I)

Surface Water Contamination Cluster/Outlier (Local Moran's I)
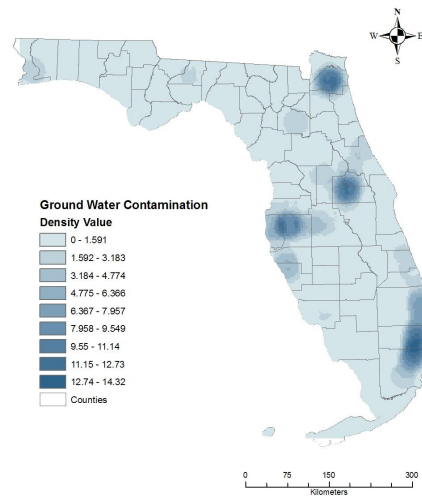
Surface Water Contamination Hot Spots (Getis-Ord Gi*)
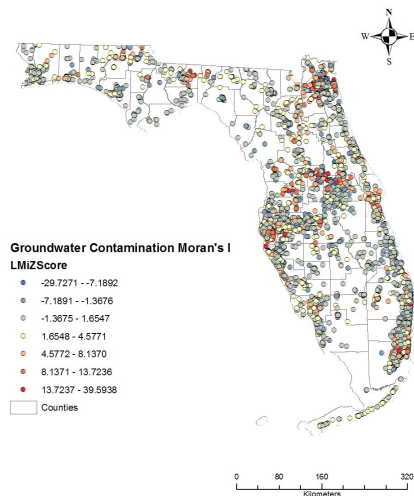
Surface Water Contamination Hot Spots (Getis-Ord Gi*)

Groundwater

▸ Density of contamination

Groundwater Contamination Density

Ground Water Contamination Density Value
- 0 - 1.591
- 1.592 - 3.183
- 3.184 - 4.774
- 4.775 - 6.366
- 6.367 - 7.957
- 7.958 - 9.549
- 9.55 - 11.14
- 11.15 - 12.73
- 12.74 - 14.32
- Counties

0   75   150   300
Kilometers

Groundwater Contamination Cluster/Outlier (Local Moran's I)

Groundwater Contamination Moran's I LMiZScore
- -29.7271 - -7.1892
- -7.1891 - -1.3676
- -1.3675 - 1.6547
- 1.6548 - 4.5771
- 4.5772 - 8.1370
- 8.1371 - 13.7236
- 13.7237 - 39.5938
- Counties

0   80   160   320
Kilometers

Groundwater Contamination Cluster/Outlier (Local Moran's I)

Groundwater Contamination Moran's I LMiIndex
- -7.5202 - -2.9520
- -2.9519 - -0.8889
- -0.8888 - 0.0423
- 0.0424 - 0.5103
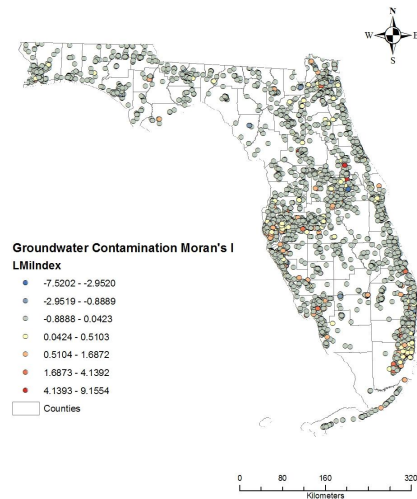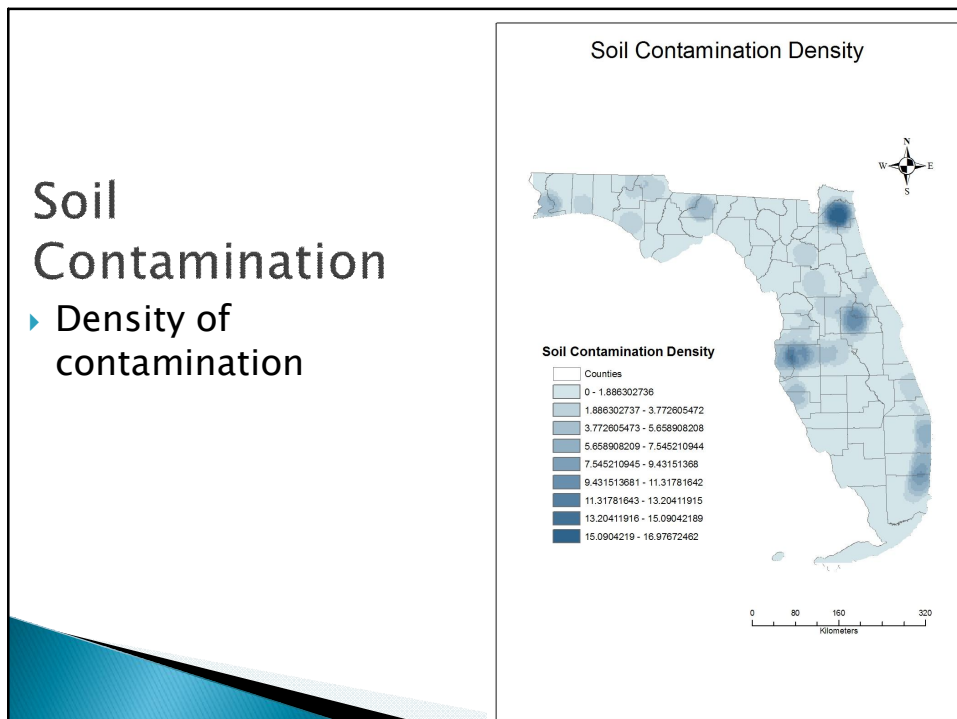- 0.5104 - 1.6872
- 1.6873 - 4.1392
- 4.1393 - 9.1554
- Counties

0   80   160   320
Kilometers

Slide 1

Groundwater Contamination Hot Spots
(Getis-Ord Gi*)

Grondwater Contamination HotSpots
GiZScore
- < -2.58 Std. Dev.
- -2.58 - -1.96 Std. Dev.
- -1.96 - -1.65 Std. Dev.
- -1.65 - 1.65 Std. Dev
- 1.65 - 1.96 Std. Dev.
- 1.96 - 2.58 Std. Dev.
- > 2.58 Std. Dev.
- Counties

0   75   150   300
Kilometers

Groundwater Contamination Hot Spots
(Getis-Ord Gi*)

Grondwater Contamination HotSpots
GiPValue
- 0.000037 - 0.098029
- 0.098030 - 0.222777
- 0.222778 - 0.315969
- 0.315970 - 0.403289
- 0.403290 - 0.601337
- 0.601338 - 0.834750
- 0.834751 - 0.997819
- Counties

0   75   150   300
Kilometers

Slide 2

Soil Contamination

▸ Density of contamination

Soil Contamination Density

Soil Contamination Density
- Counties
- 0 - 1.886302736
- 1.886302737 - 3.772605472
- 3.772605473 - 5.658908208
- 5.658908209 - 7.545210944
- 7.545210945 - 9.43151368
- 9.431513681 - 11.31781642
- 11.31781643 - 13.20411915
- 13.20411916 - 15.09042189
- 15.0904219 - 16.97672462

0   80   160   320
Kilometers

Conclusions

- ▸ High density areas of measured petroleum values lie primarily in urban areas.
- ▸ The clustering and dispersion of petroleum contamination in different mediums does not always follow an expected pattern.

Limitations

- ▸ Data Overload
- ▸ No specific contaminant levels
- ▸ Vague information about Score calculation.

Future Work

- ▸ Further analysis of current results
  - ◦ Other statistical tests
  - ◦ Look into analysis outcome
- ▸ Continued differentiation by attributes.
- ▸ Statistical comparison of scores between areas which are and are not currently requiring remediation.

Questions?