A Spatial Interpolation and Colocated Analysis of Stormwater Failure and 303(d) Impaired Streams in the Metropolitan North Georgia Water Planning District

Georgia State University | Department of GEOSCIENCES

Imani Vincent, Advanced GIS, GEOS 6534
Department of Geosciences, Georgia State University

Atlanta Regional Commission

Introduction

- Stormwater is water from rain events that can stay on the surface, soak into soil and runoff into water bodies.
- Stormwater runoff carries pollutants from urban landscapes, into streams which causes them to become impaired and compromises water quality.
- A rise in urbanization in the District has accelerated stormwater runoff, posing challenges to water quality and infrastructure.
- More than 1,500 miles of streams in the District are considered impaired and do not meet state water quality standards, due to non-point source pollution caused by rainfall runoff, as well as natural and human-made pollutants (US EPA).
- This study shows the spatial representation and analysis facilitating informed decision-making for watershed management and environmental protection initiatives in the District

Study Area & Data

- This study details a comprehensive spatial analysis integrating stormwater failure, including sinkholes, and flooding events, and their impact on impaired streams within the Metropolitan North Georgia Water Planning District, other known as the “District” which covers 15 counties.
- (1) Is there a spatial correlation between the stormwater failure events and the303(d) impaired streams, and how do they correlations differ across different geographic regions within the District? (2) What are the key hotspots of stormwater failure identified through spatial analysis?

Methods

- Created a map of Stormwater Failure in the District (Figure. 5).
- Performed Colocation Analysis between flooding and sinkholes and then proceeded to implement a Inverse Distance Weighting (IDW) interpolation of the colocated analysis points (Figure 1 & 2). Used the Buffer tool around the impaired streams and extracted the interpolated points to create a heat map to illustrate hot spots to view proximity to impaired streams.

Results

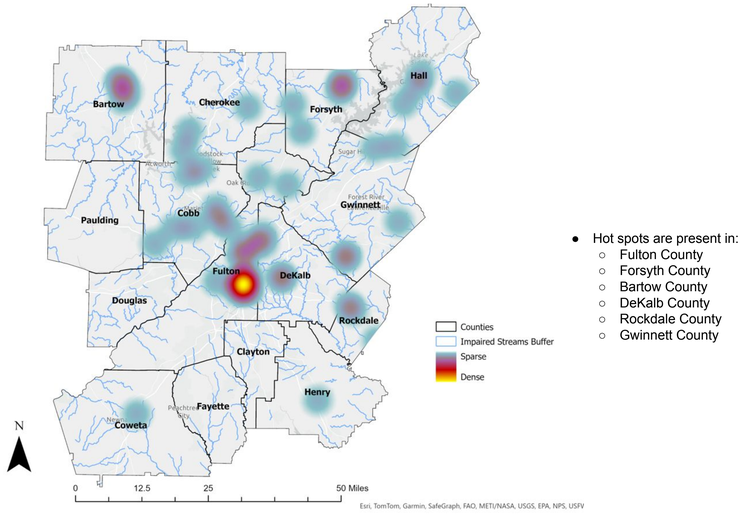

Figure 1. Heat Map of Interpolated Colocated Stormwater Failure Locations

- Hot spots are present in:
  - Fulton County
  - Forsyth County
  - Bartow County
  - DeKalb County
  - Rockdale County
  - Gwinnett County

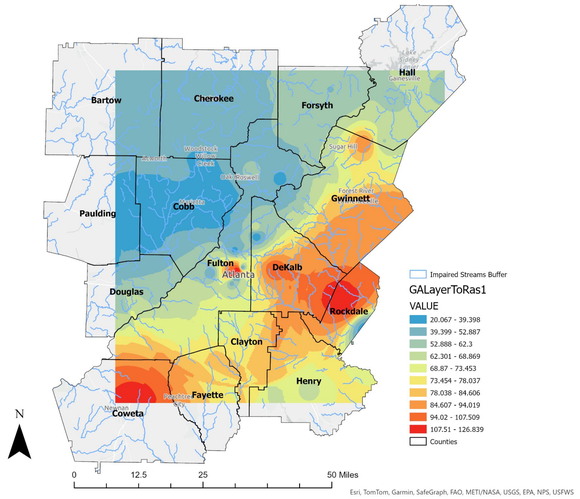

Figure 2. Inverse Distance Weighted Map of Stormwater Failure

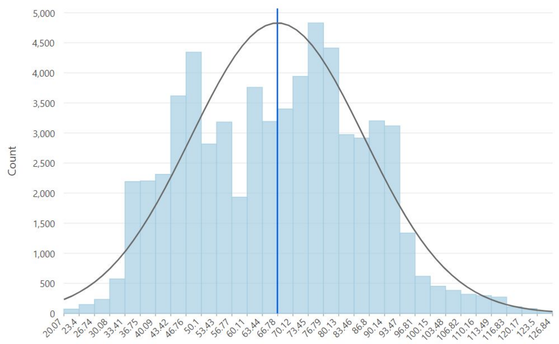

Figure 3. Inverse Distance Weighted Mean Distribution

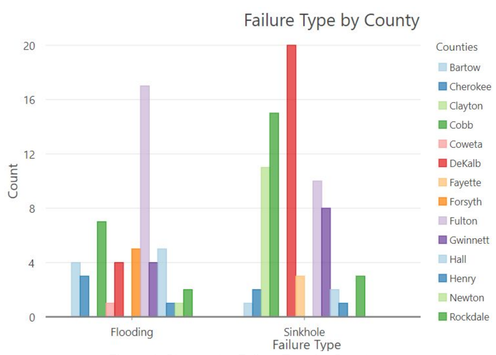

Figure 4. Stormwater Failure Type by County

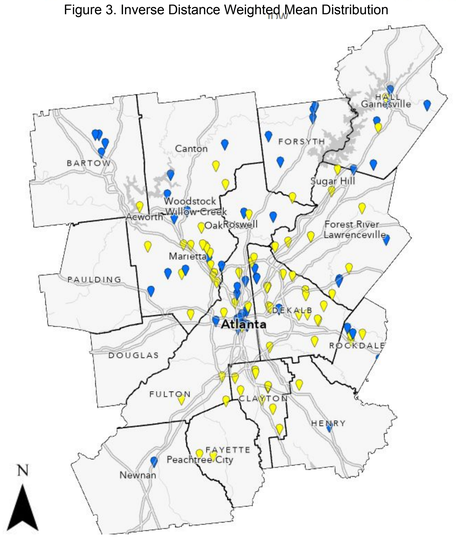

Figure 5. Map of Stormwater Failure

Conclusion

- The results of this study contribute to a better understanding of the interconnectedness of environmental impact of stormwater failure and on impaired streams within the District. This information is invaluable for organizations, and local governments involved in watershed management, regulatory compliance, and environmental protection initiatives in North Georgia's Metropolitan District.

Future Work

- Future research could expand upon this study by adding in another component, such as specific water quality data of the impaired streams to further enhance the spatial analysis
- Incorporate mitigation Strategies for stormwater management include the use of green infrastructure (such as rain gardens and permeable pavement), stormwater retention ponds for protecting water quality, preventing flooding, and maintaining the health of aquatic ecosystems.

References

“Role of GIS as a Tool for Environmental Planning and Management.” *International Journal of Research in Environmental Science*, vol. 5, no. 1, 2019. *DOI.org (Crossref)*, https://doi.org/10.20431/2454-9444.0501002.

US EPA, OW. *Basic Information about Nonpoint Source (NPS) Pollution*. 15 Sept. 2015, https://www.epa.gov/nps/basic-information-about-non point-source-nps-pollution.

“Resources, Plans & Studies.” *Metropolitan North Georgia Water Planning District*, 2022. https://northgeorgiawater.org/utilities-board-committees/resources-plans/.