Data Analysis Report on Flood Patterns and Prediction in Lagos State

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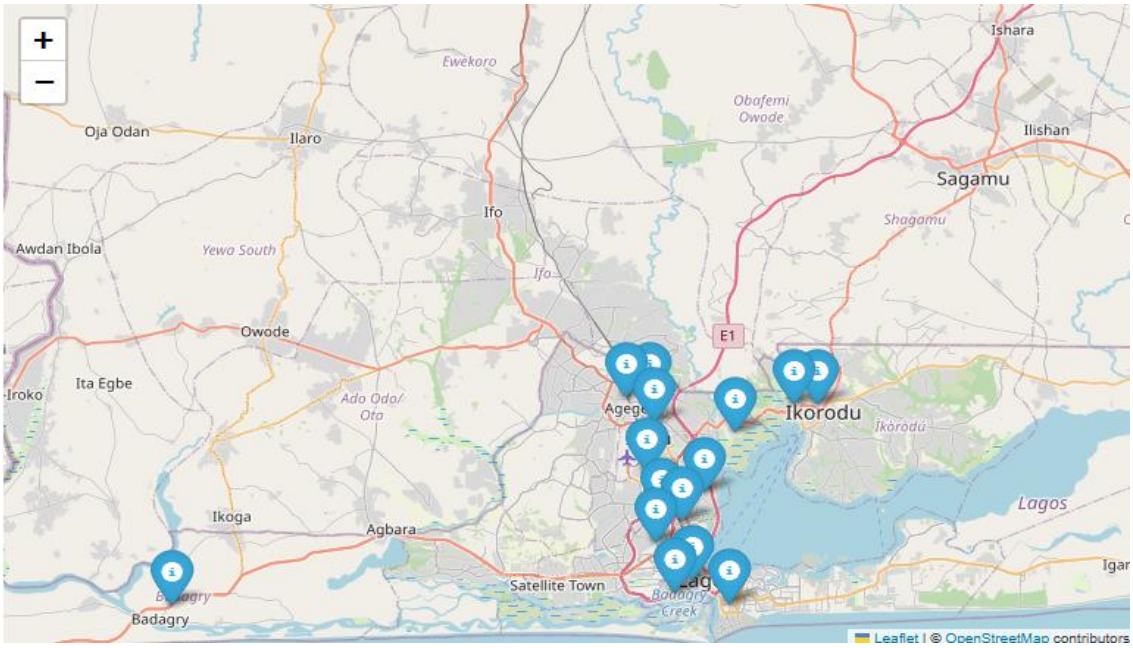
Table of Contents

Introduction

Lagos State, being a coastal region with a diverse topography, frequently faces flood events, particularly during the rainy season.



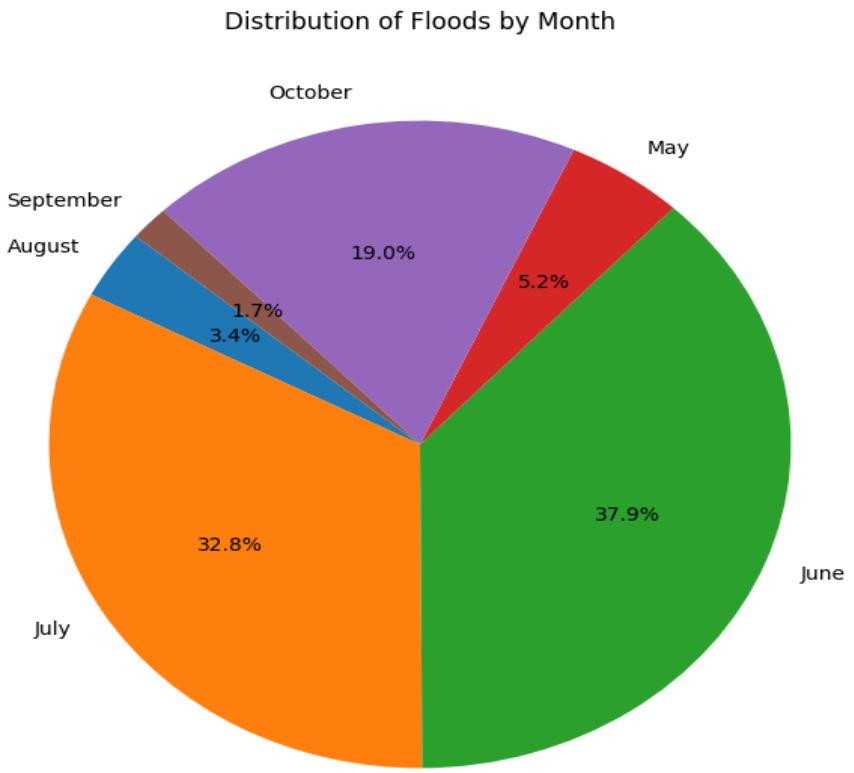
Map of Lagos State with LGAs as marker

This report provides an in-depth analysis of flood patterns in Lagos State and predicts future flood occurrences using machine learning models. The analysis considers various factors such as topography, historical flood events, and weather patterns.

Executive Summary

The primary goal of this analysis was to understand the flood patterns in Lagos State and predict future flood occurrences. The analysis revealed that LGAs with the lowest points face the highest risk of flooding. Historical data shows that the LGAs with the most flood records are also the most susceptible to future floods. The months of June, July, and October have the highest number of recorded floods, falling into the rainy and post-rainy seasons, which experience the highest average rainfall days and amounts.

The risk of flooding during the dry season is minimal in most LGAs. Data collection was challenging due to poor data culture, but through web scraping and utilizing past engineering project data, we gathered sufficient information for exploratory data analysis and model development. The model predicts that the next likely flood will occur in June/July 2025 unless engineering interventions are implemented.



Plot show Flood event by month

Methodology

- Data Collection: Data was collected from various sources, including historical flood records, weather data, and topographic information of Lagos State. The primary sources included web scraping and data from past engineering projects on flooding. The datasets included:
    - Historical flood events and their locations.
    - Weather metrics such as average temperature, rainfall, and rainfall days.
    - Topographic data of the LGAs in Lagos State.

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- Data Preprocessing: The data was cleaned and preprocessed to ensure consistency and accuracy. Key steps included:
    - Parsing and formatting date fields.
    - Handling missing values and inconsistencies.
    - Mapping categorical data to numerical values for model training.

- Exploratory Data Analysis (EDA): EDA was performed to uncover patterns and insights within the data. Visualizations such as histograms, scatter plots, and heatmaps were used to understand the relationships between different variables.

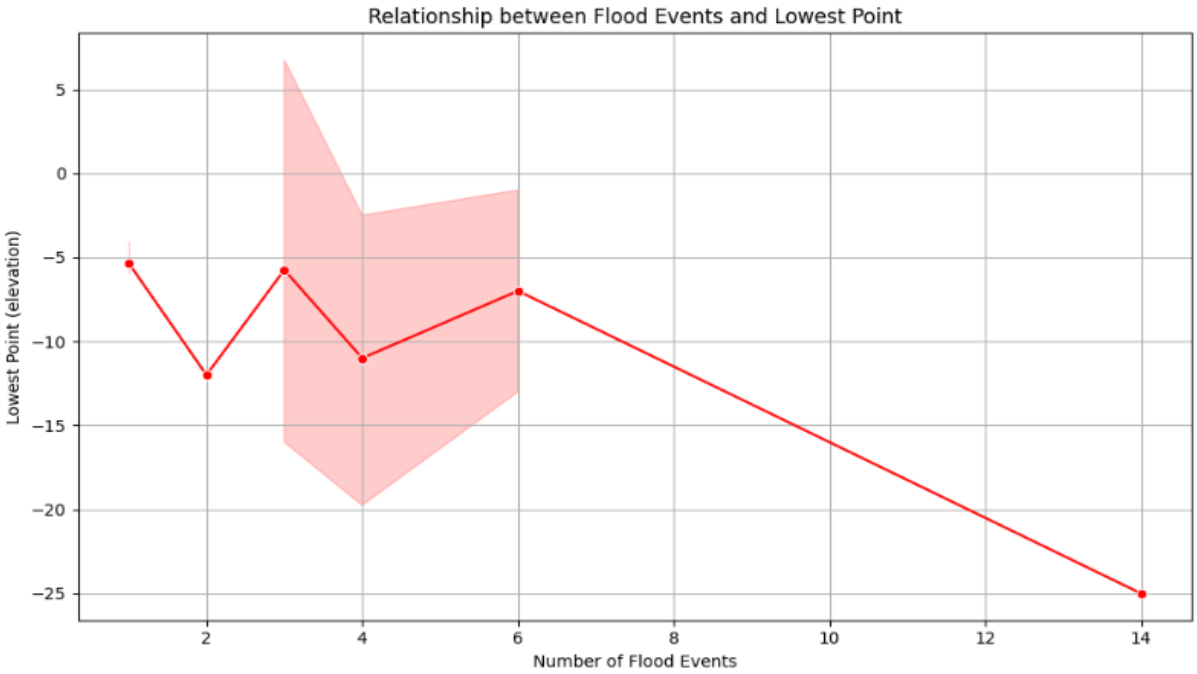
- Model Development: A RandomForestClassifier was used to predict future flood occurrences. The model was trained using historical flood data and weather metrics. Features included average rainfall, average temperature, season, and topographic data.

- Testing the Model: To test the model, a new dataset was generated assuming floods occurred in all LGAs in June and July 2024. This dataset was used to evaluate the model's predictive capabilities.

Insights

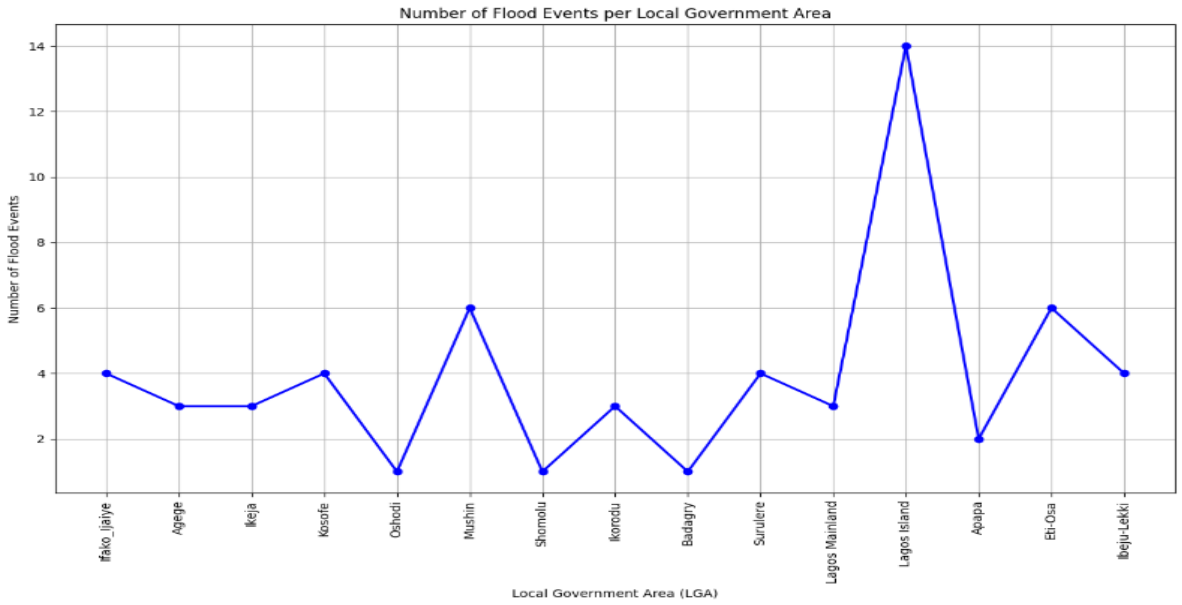
Flood Risk by Topography

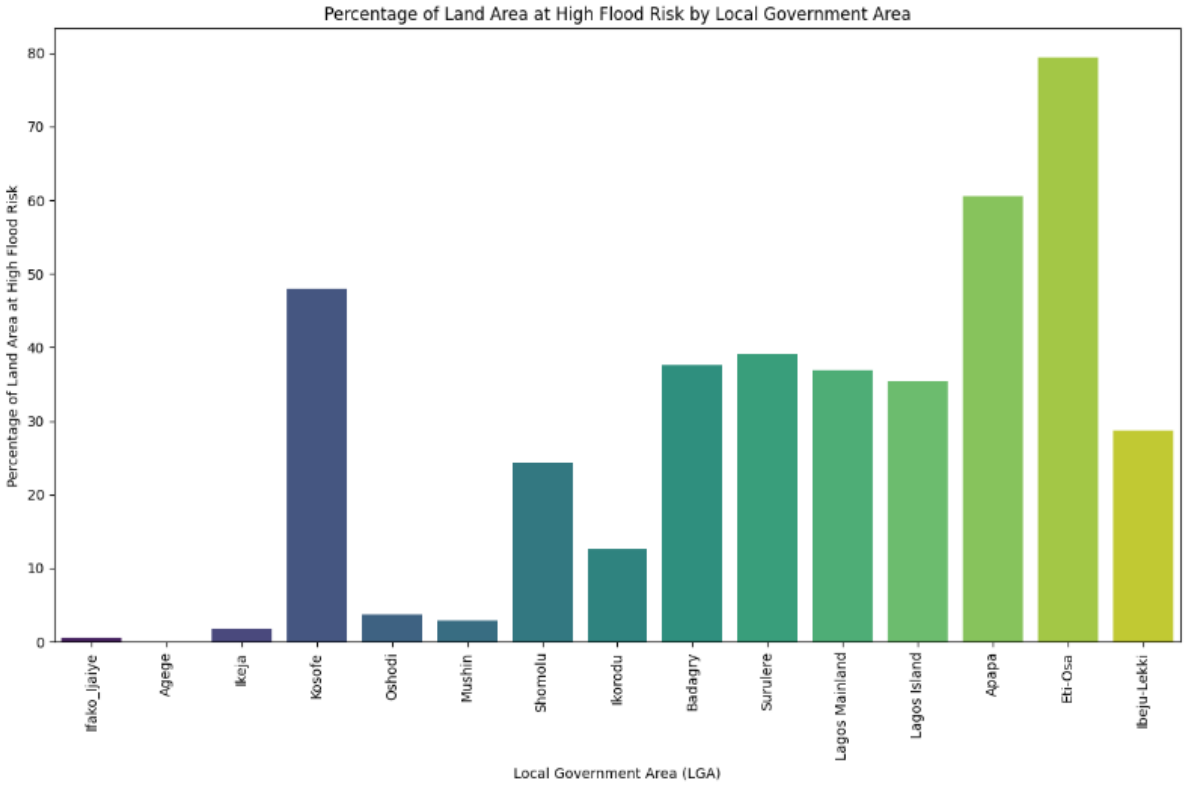
- LGAs with the lowest points are at the highest risk of flooding. These areas are more susceptible to water accumulation during heavy rainfall. Chart below show that LGAs with the lowest elevation has faced the highest number of flood events.



Historical Flood Records

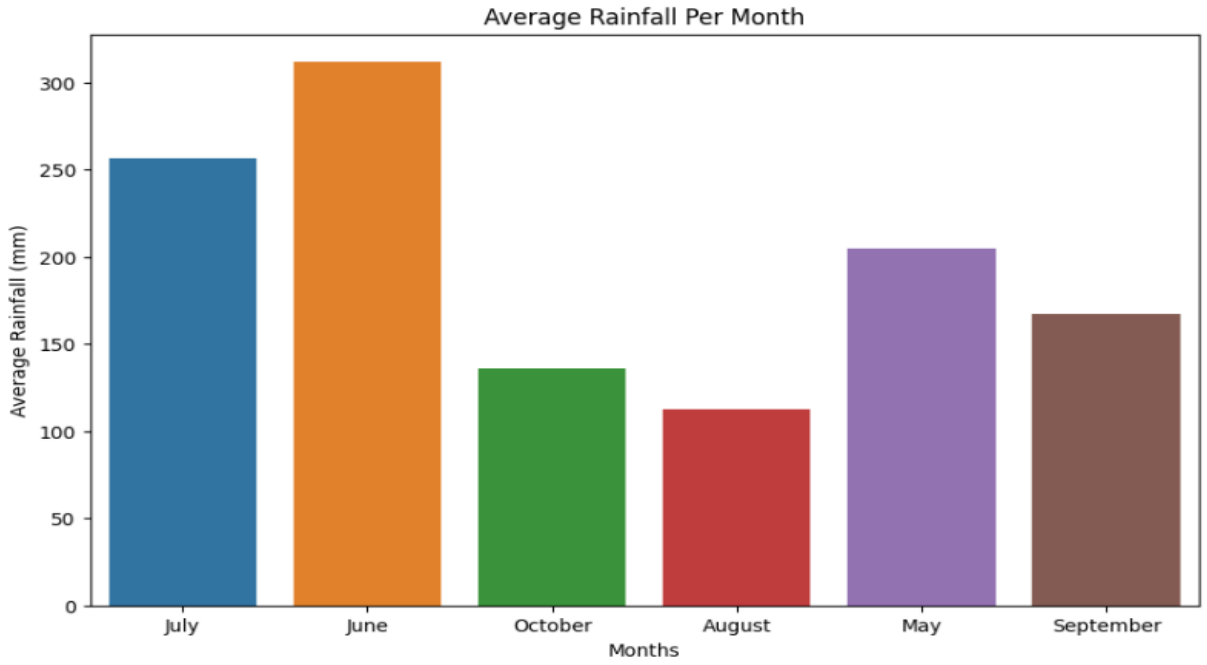
- The LGAs with the most flood records are also the most likely to experience future floods. This indicates a pattern of recurring flood events in these areas. The charts below show flood history by LGAs and ones mostly to experience flood in the near future.



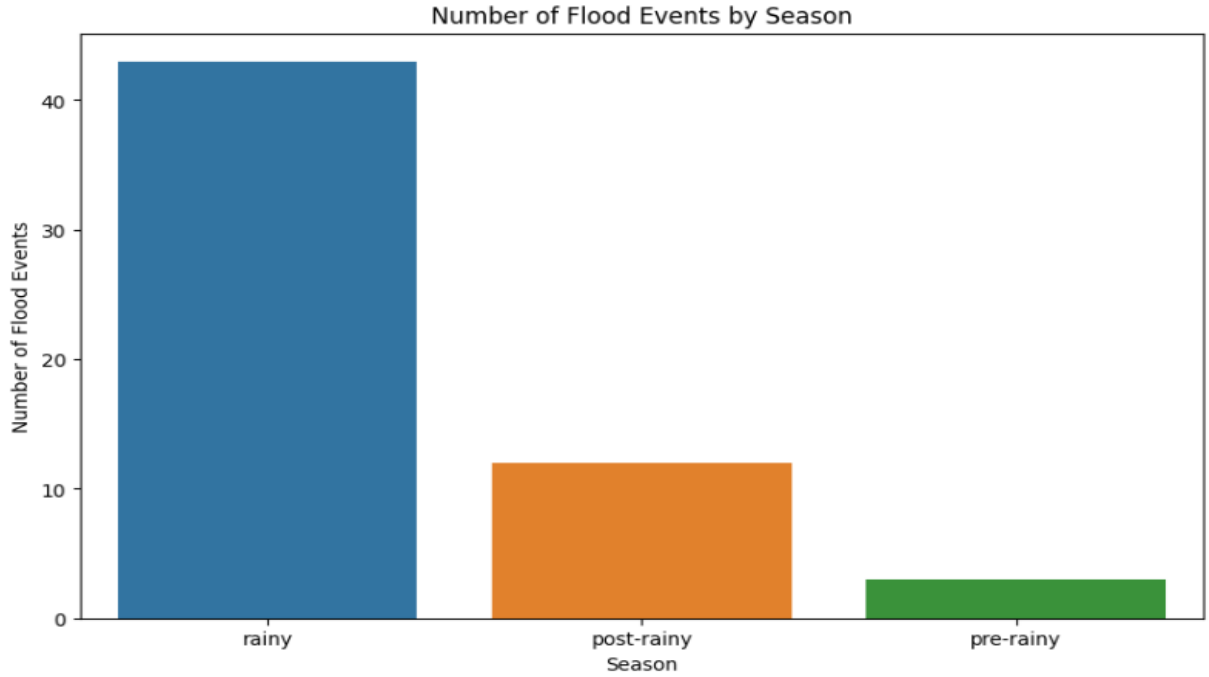


Seasonal Flood Patterns

- The months of June, July, and October have the highest number of recorded floods. These months fall into the rainy and post-rainy seasons, characterized by the highest average rainfall days and amounts.

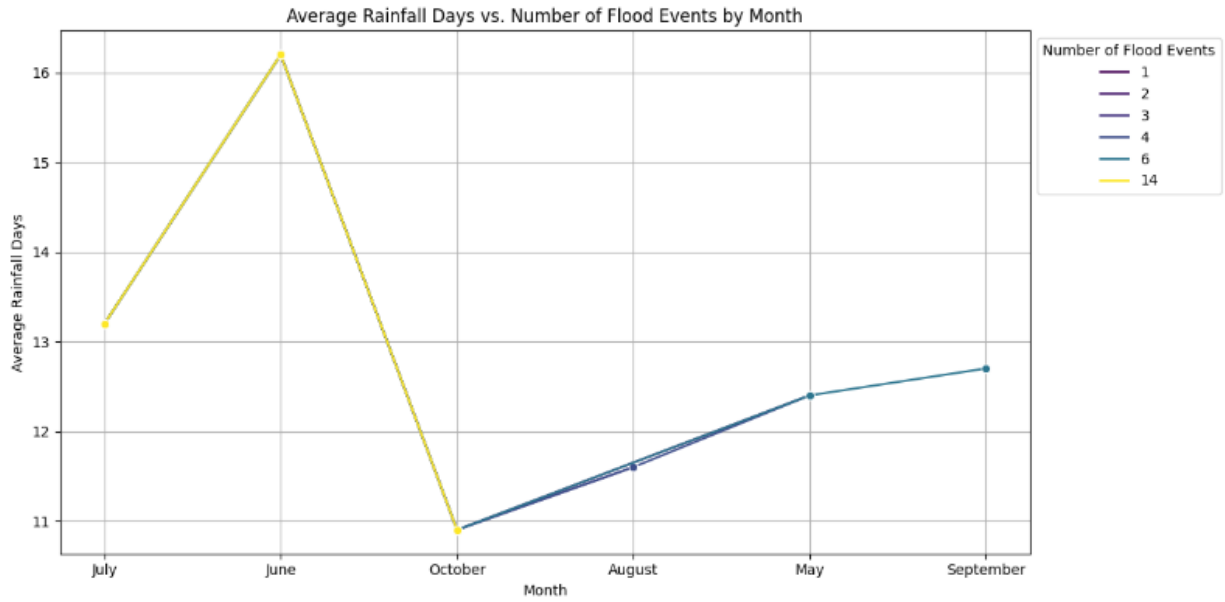


High rainfall in June/July makes it months most likely for flood event



Majority of flood events occur in the rainy and post rainy season

- The dry season has a minimal risk of flooding in most LGAs, suggesting that rainfall is a significant factor in flood occurrences.\

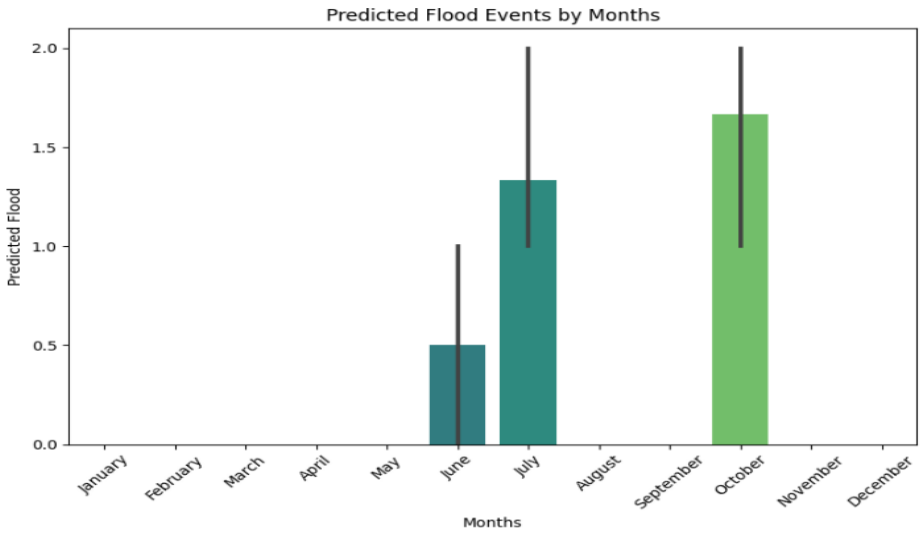


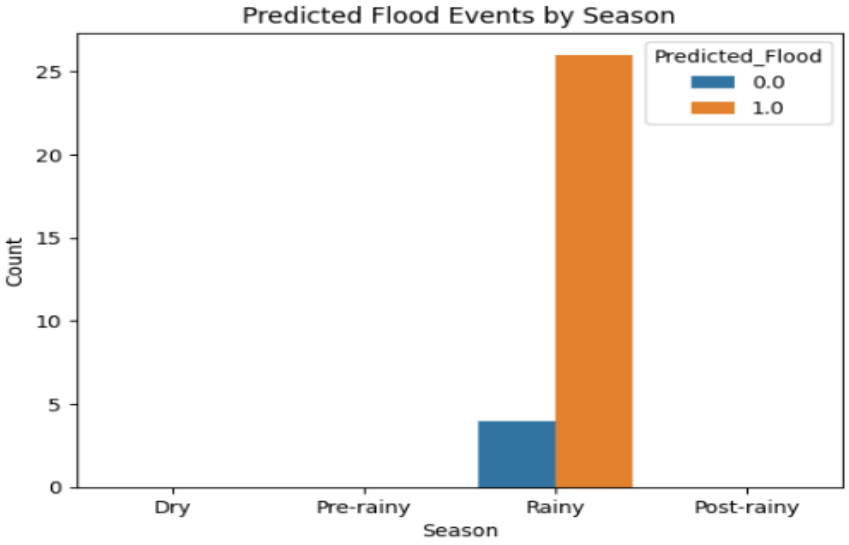
Data Collection Challenges

- Data collection was challenging due to the poor data culture of concerned parties in Nigeria. However, web scraping and leveraging data from past engineering projects helped gather the necessary information for analysis.

Discussion

The analysis highlights the importance of understanding topographic and weather patterns in predicting flood events. The findings emphasize the need for targeted interventions in high-risk LGAs, particularly during the rainy and post-rainy seasons. The model's predictions for June/July 2025 align with historical trends, suggesting that these months will likely experience flood events unless preventive measures are taken.





The data collection challenges underscore the need for improved data management practices in Nigeria. Better data availability and accuracy would enhance predictive modeling and disaster management efforts.

Conclusion

This report provides a comprehensive analysis of flood patterns in Lagos State and predicts future flood occurrences using a RandomForestClassifier model. Key findings

indicate that LGAs with the lowest points and the most historical flood records are at the highest risk. The rainy and post-rainy seasons are particularly critical periods for flood events.

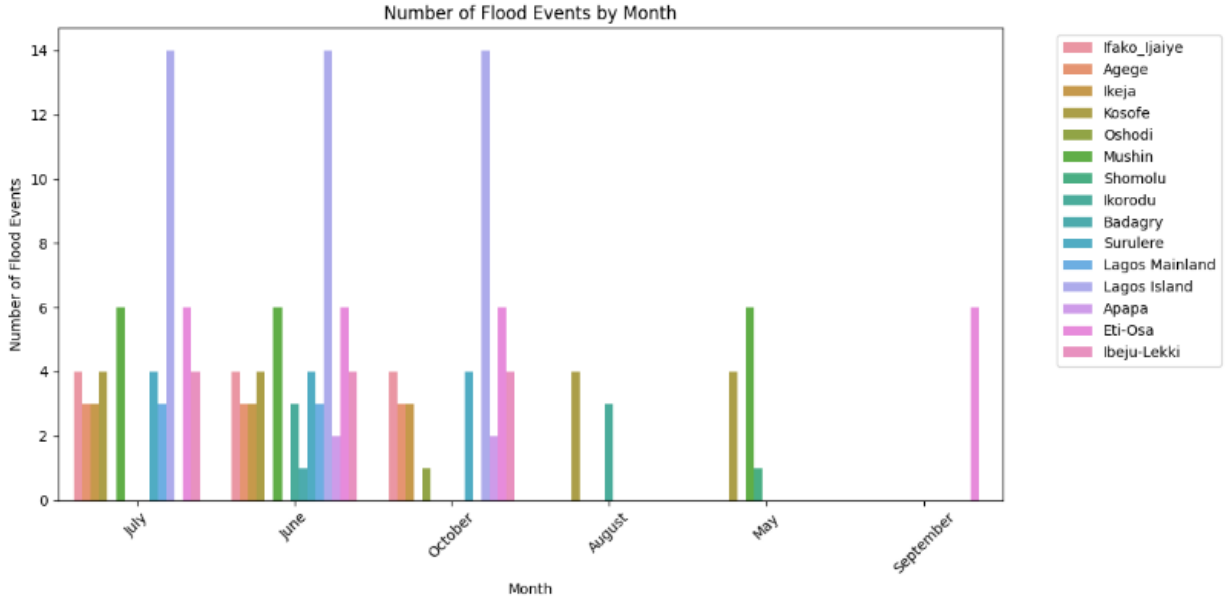
Improved data collection practices and targeted engineering interventions are essential to mitigate flood risks. The model predicts that the next likely flood will occur in June/July 2025, highlighting the urgency for preventive measures.

Future Work

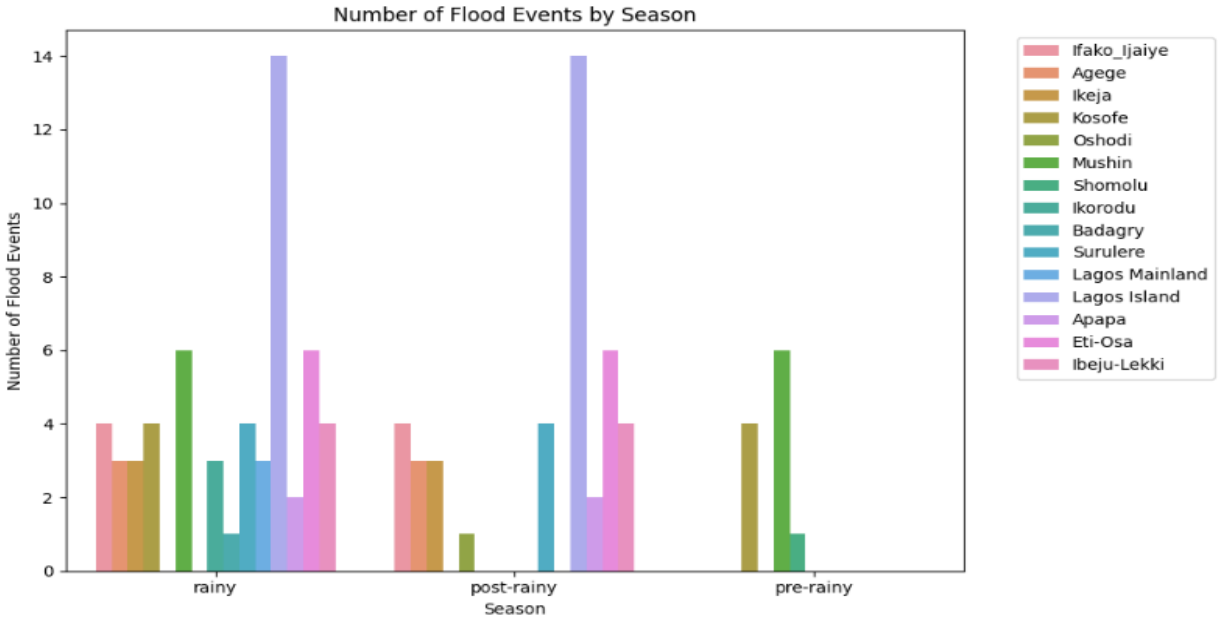
- Data Enhancement: Continued efforts to improve data collection and accuracy.

- Model Improvement: Incorporating additional features and exploring more advanced machine learning models.

- Preventive Measures: Developing and implementing engineering interventions to reduce flood risks, particularly in high-risk LGAs.



This report serves as a foundation for understanding and addressing flood risks in Lagos State, providing valuable insights for policymakers and stakeholders in disaster management and urban planning.


Number of Flood Events by Season
Number of Flood Events
0
2
4
6
8
10
12
14
rainy
post-rainy
pre-rainy
Season
Ifako_Ijaiye
Agege
Ikeja
Kosofe
Oshodi
Mushin
Shomolu
Ikorodu
Badagry
Surulere
Lagos Mainland
Lagos Island
Apapa
Eti-Osa
Ibeju-Lekki