



Development of a GIS-Based Environmental Screening and Decision Support Tool for Infrastructure Projects in Puerto Rico

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ABSTRACT

This project developed a GIS-based Environmental Screening and Decision Support Tool to support infrastructure planning and environmental review processes in Puerto Rico. Using QGIS, multiple environmental datasets including FEMA Flood Zones, wetlands, coastal zone boundaries, industrial land use, and urbanized areas were integrated into a unified spatial framework. Spatial overlay analyses were performed to evaluate environmental constraints and quantify overlap areas between infrastructure projects and environmentally sensitive areas. A preliminary environmental risk scoring methodology was developed and applied to case study projects within the San Juan metropolitan area. The results demonstrate that GIS-based environmental screening can support early project planning, improve environmental awareness, and assist decision-making processes for infrastructure development projects.

METHODOLOGY

1. Environmental datasets were collected from FEMA, NOAA, USFWS, Puerto Rico Planning Board, and OpenStreetMap.
2. Datasets were imported into QGIS and standardized into a unified spatial framework.
3. Environmental constraint layers were developed including:
 - Flood Zones
 - Wetlands
 - Coastal Zone Areas
 - Industrial Areas
 - Urban Areas
4. Spatial overlay analyses were performed between project footprints and environmental layers.
5. Environmental overlap areas and percentages were calculated.
6. A preliminary environmental risk scoring methodology was developed.

DISCUSSION

The project demonstrated that GIS-based environmental screening can improve the efficiency of environmental planning workflows by consolidating multiple environmental datasets into a single analytical framework. The methodology can support early-stage environmental awareness and assist decision-making processes before detailed environmental review phases occur. As demonstrated for the case study in San Juan, Puerto Rico



CASE STUDY

Three infrastructure project case studies located within the San Juan metropolitan area were analyzed using the developed GIS methodology. The projects included transportation, pedestrian access, and coastal infrastructure components. Environmental overlap analyses were conducted using flood zone, wetland, coastal zone, industrial land use, and urban area datasets.



RESULTS

The environmental screening analysis identified varying levels of environmental constraints among the evaluated case study projects. Project C obtained the highest overall environmental risk score due to increased overlap with flood zones, coastal areas, wetlands, and industrial land use areas. Projects A and B obtained moderate overall scores with lower environmental overlap values.

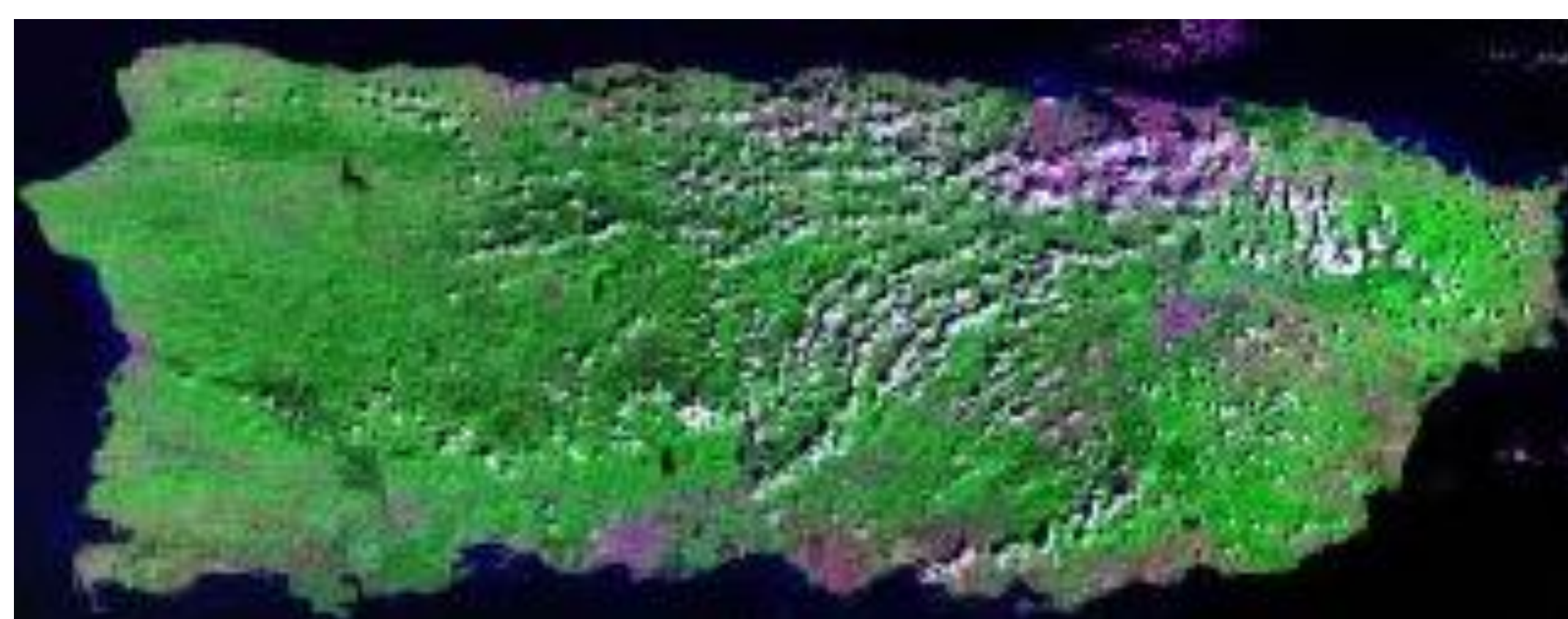
Project	Flood	Wetlands	Industrial	Urban	Coastal	Final Score
Project A	3.2	0	0	2	1	6.2
Project B	2.2	0	1	2	1	6.2
Project C	5.6	1	2	1	2	11.6

Final Score	Risk Level
0-4	Low
4.1-7	Medium
7.1-10	High
>10	Very High

INTRODUCTION

Puerto Rico faces increasing environmental and infrastructure planning challenges associated with urban development, coastal exposure, flooding, and environmentally sensitive resources. Infrastructure projects frequently require environmental review processes involving multiple agencies and datasets. Traditional environmental screening approaches can be time-consuming and fragmented.

This project proposes the development of a GIS-based Environmental Screening and Decision Support Tool capable of integrating multiple environmental datasets into a single spatial workflow. The tool was developed using QGIS and applied to infrastructure project case studies within the San Juan metropolitan area.



OBJECTIVES

- Develop GIS decision-support tool
- Compile environmental datasets
- Create environmental constraint layers
- Perform spatial overlay analyses
- Quantify environmental overlap areas
- Develop environmental risk scoring method
- Apply methodology to case studies
- Evaluate screening effectiveness

CONCLUSION

This project successfully developed a GIS-based Environmental Screening and Decision Support Tool capable of supporting infrastructure planning and environmental review processes in Puerto Rico. The integration of multiple environmental datasets, spatial overlay analyses, and preliminary risk scoring methodologies demonstrated the effectiveness of GIS tools for identifying environmental constraints during early project planning stages. The methodology provided an organized framework for evaluating flood zones, wetlands, coastal areas, industrial land use, and urban environments within infrastructure project areas. The results demonstrated that GIS-based environmental screening can improve environmental awareness, support decision-making processes, and assist with preliminary environmental planning efforts. Additionally, the developed methodology can be expanded in the future through the integration of additional GIS environmental datasets, automated analytical workflows, and enhanced environmental risk scoring methods to support more comprehensive environmental screening applications.

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