Exploring synergies between New Jersey Regional Resilience Adaptation Action Plans (RRAAP), Engineering Students capstone projects, and Environmental Justice & Equity

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Introduction

The Resilient NJ program has funded the development of RRAAPs in Northeastern NJ, Raritan River & Bay Communities, Long Beach Island, and Coastal Atlantic County. These plans aim to preserve natural resources, design resilient infrastructure, and help communities make informed decisions in coastal flood zones. This research will evaluate how these plans address environmental justice and equity and assess their suitability for engineering student engagement through senior design, capstone, or thesis projects.

Methods

To narrow down the four plans, which contain hundreds of actions, two were selected based on the metrics of Environmental Justice Communities and Social Vulnerability. Environmental Justice was assessed using the EJMAP tool, measuring the percentage of OBC-designated block groups in each municipality. Social Vulnerability Index (SVI) data from 2018 and 2022 was used to evaluate the counties in each plan.

Action Plan	% of EJC per Area	County SVI 2018	County SVI 2022
NENJ	84.26	0.8	0.83
RRBC	80.10	0.55	0.55
ACCR	54.12	0.95	0.85
LBI	0	0.45	0.45

The top two plans were selected, and their actions ranked using a weighted scoring model based on Environmental Justice. With each category being weighed by its connection to Environmental Justice. Six impact categories were used: Design Life and Adaptability (15%), Cost and Feasibility (10%), Risk Reduction (25%), Environmental Benefits (20%), Community and Health Benefits (20%), and Economic Growth (10%). Economic Growth was defined by job creation, potential for tourism, and infrastructure spending.

Once the actions are narrowed to consider Environmental Justice, the next step is to condense these actions based on their potential to be projects that engineering students can undertake. Specifically, each action will be analyzed to determine if it is a research project, design project, or both, as well as if the scope of the project is fit for an engineering student.

Results & Discussion

The NENJ and RRBC Action Plans had the strongest connection to Environmental Justice, with 269 actions analyzed. Of these, 108 scored above 90% using the Environmental Justice model, with 76 suitable for engineering students. These actions were organized in a database, labeled by type (e.g., Stormwater Management, Coastal Resilience, Zoning and Land Use Policy), with descriptions, priorities, next steps, and recommended engineering disciplines. Actions with specified sites were checked against New Jersey's Environmental Justice Law, focusing on Overburdened Communities with high stressor summaries. Actions without specified sites were assessed for their potential impact on Environmental Justice block groups.

Impact on Underserved Communities / Conclusion

The actions within the 4 RRAAPs were ranked through criteria which focused on Environmental Justice Communities and the sustainability of the actions was also considered by emphasizing actions which positively impact the environment and designs that would be effective in the long term. To assist students looking for projects in the future, an action database of potential projects was created. Out of all the final actions, 59 were directly located in Environmental Justice Communities with stressor levels above the 50th percentile. This means that approximately 78% of the actions in this database will directly aid Environmental Justice Communities. Thus, through this database, engineering students will have the necessary information to find potential senior design, capstone, or thesis projects that will greatly impact underserved communities. By presenting these projects to students, the actions have a better chance of being executed swiftly, and the Environmental Justice Communities encompassed by the plans have a better chance of receiving the support they need. Overall, it was concluded that there is a significant opportunity for engineering students to aid Environmental Justice Communities in New Jersey through projects tackling the actions presented in the RRAAPs.

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