



GREEN INFRASTRUCTURE FOR URBAN SUSTAINABILITY: ISSUES, IMPLICATIONS, AND SOLUTIONS FOR UNDERDEVELOPED AREAS IN JAMAICA

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BACKGROUND

PROFESSIONAL QUALIFICATION:

- Currently Pursuing an MSc. Engineering and Management, UWI Mona
- Professional Engineer (Civil & Structural), PERB
- Certificate in Project Management
- B.Eng. Civil Engineering, UTECH
- Associate Degree in Architectural and Construction Technology, KNOX

Professional Affiliation

- Corporate Member -Jamaica Institution of Engineers, JIE
- (JIE) Council Member in the capacity of Ordinary Member (Council Year 2022/23)

Special Attainment

- Lieutenant – Jamaica Combined Cadet Force, 2014-Present
- Appointed Adjutant/Quartermaster 8th Battalion, Eastern Regiment, (2022- Present Date)

WORK EXPERIENCE

- Executive Engineer, Peter Jervis & Associates (7 Years)

OUTLINE OF PRESENTATION

- Introduction
- Definitions
- Benefits
- Issues
- Implications
- Solutions
- Opportunities
- Conclusion

RESEARCH QUESTIONS

- What lessons can be learned from successful green infrastructure projects in other countries and how can they be adapted and implemented?
- What potential benefits does green infrastructure offer to the local economy?
- What are the limitations or drawbacks associated with the adoption of green infrastructure?
- What are the key challenges faced by implementing green infrastructure for urban sustainability?
- How does the adoption of green infrastructure help in mitigating the effects of urbanization on the environment in Jamaica?

“WHAT IS AN UNDERDEVELOPED AREA?”

- Typically refers to a geographic region or urban locality that lags behind in terms of economic development, infrastructure, access to basic services, and overall quality of life compared to more developed or affluent areas within the same country.
- **Limited Infrastructure**
- **Limited Access to Green Spaces**
- **Environmental Vulnerability**

WHAT IS GREEN INFRASTRUCTURE?

Conservation Areas/
Forested Land

Parks/Urban
Tree Canopy

Green Roofs

Rain Barrels

Rain Gardens

Tree + Planter
Boxes

Stormwater
Curb Extensions

Permeable
Pavement

Grow Zones +
Vegetative Swales

Bioswales

A structured network of Natural and Engineered elements designed to provide environmental, social, and economic benefits.

Example

- Parks
- Green Roofs
- Rain Gardens
- Urban Forests
- Wetlands
- Permeable Pavements

EXAMPLES OF GREEN INFRASTRUCTURE

Green infrastructure is not a new idea. It is an all-inclusive name for how natural environmental elements can be easily incorporated into the built environment.

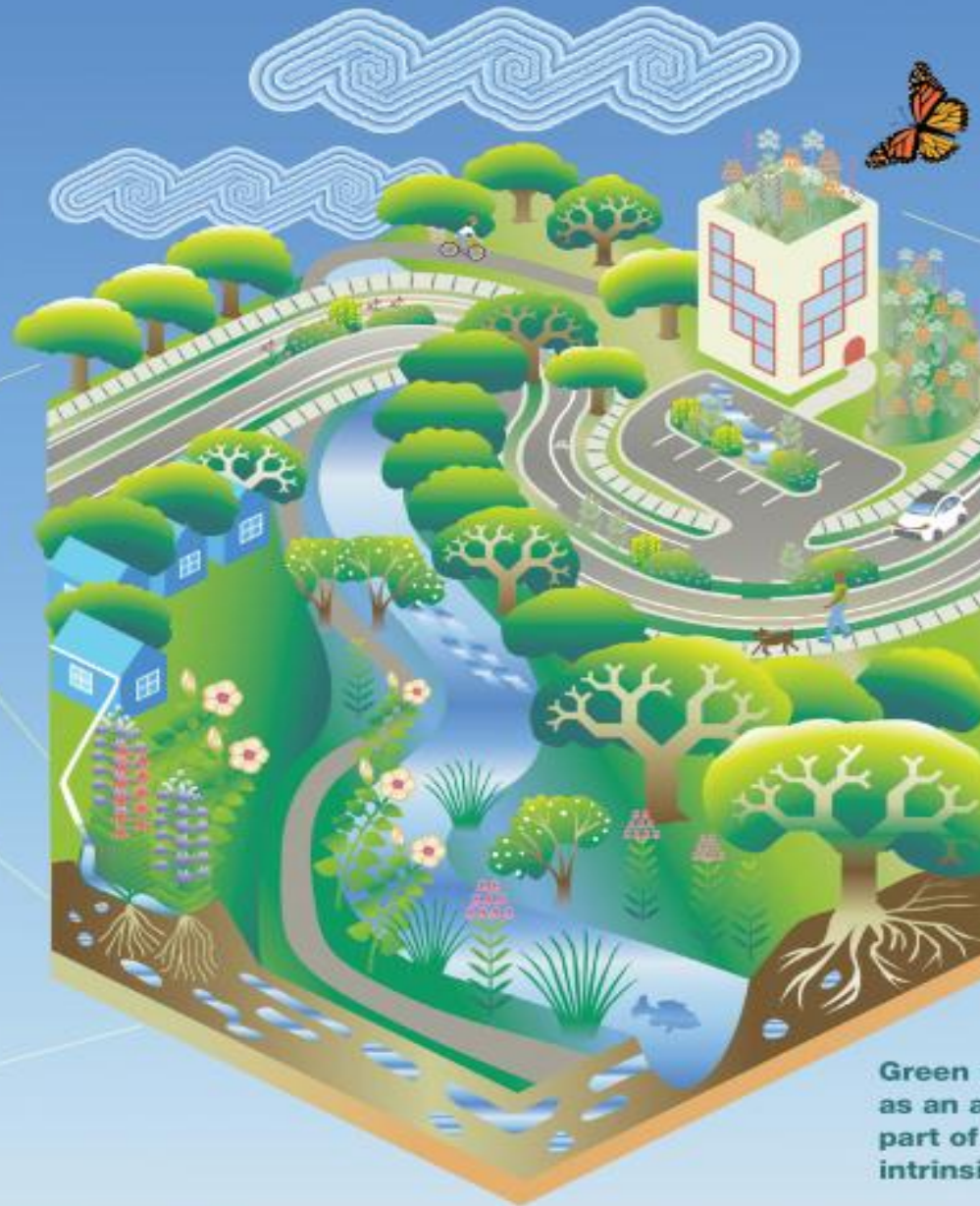
The elements that make up green infrastructure are straightforward: trees, rain gardens, native landscaping, green roofs and bioretention features. These elements can be deployed in various combinations in commercial, residential and natural settings.

STREET TREES are integral to complete streets. Trees make streets more walkable, provide shade to save energy, and intercept and soak in rainwater.

RAIN GARDENS and native landscaping absorb stormwater runoff from rooftops and driveways in residential neighborhoods.

NATIVE PLANTS have deeper root systems that help soil absorb and retain water. Using native plants reduces the need for lawn chemicals and irrigation.

STREAMSIDE CORRIDORS are home to well-used trails and beautiful natural areas. Planting stream buffers with trees or native plants — and removing invasive plants like shrub honeysuckle — cleans the air and water and creates valuable wildlife habitat.



Green infrastructure concepts are already embedded in many adopted local and regional plans and policies. The Green Infrastructure Framework provides a roadmap for integrated processes and new approaches to protect, preserve and restore natural areas, while meeting social and economic needs at the same time.

GREEN ROOFS on commercial buildings save energy, absorb water and reduce urban heat islands.

BIORETENTION FEATURES strategically located in parking lots reduce ecological impacts of runoff by collecting, storing and filtering stormwater.

COMPLETE STREETS accommodate all users, including pedestrians, cyclists and transit riders. Adding green infrastructure improves the streetscape, facilitates alternative transportation and enhances environmental quality.

PARKS are great places for recreation and social gatherings. Transforming mowed areas with strategically located native landscaping creates habitat for monarch butterflies, reduces mowing costs, absorbs rainwater, and reconnects residents with our natural history.

Green infrastructure should not be viewed as an amenity, but rather as an important part of how and where we grow, with intrinsic value and importance.



WHAT IS URBAN SUSTAINABILITY

- From an engineering perspective, can be defined as the practice of designing, developing, and managing urban environments and infrastructure systems in a way that meets the current and future needs of a city's residents while minimizing negative impacts on the environment, society, and the economy.

KEY ELEMENTS OF URBAN SUSTAINABILITY

- **Efficient Resource Use:** Urban sustainability involves the responsible and efficient use of natural resources, such as energy, water, and materials, in the planning and operation of urban systems. This may include energy-efficient building designs, water conservation measures, and sustainable transportation solutions.
- **Infrastructure Resilience:** Engineers work to create urban infrastructure that can withstand natural disasters, climate change impacts, and other shocks while maintaining essential services. This includes designing resilient transportation networks, flood control systems, and resilient building construction.

Key elements of urban sustainability (cont'd)

- **Environmental Protection:** Sustainable urban engineering seeks to minimize environmental degradation through strategies like green infrastructure, waste reduction, and pollution control. It also considers the preservation of natural habitats and biodiversity within urban areas.
- **Social Equity:** Urban sustainability aims to create inclusive and equitable cities by providing access to essential services and opportunities for all residents. Engineers may focus on equitable transportation solutions, affordable housing, and infrastructure accessibility.
- **Economic Viability:** Sustainable urban development must be economically viable, with a focus on long-term cost-effectiveness and job creation. Engineers often consider life-cycle cost analyses and economic feasibility when designing and implementing projects.

Key elements of urban sustainability (cont'd)

- **Technological Innovation:** Engineers play a critical role in developing and implementing innovative technologies and solutions that enhance urban sustainability, such as smart grids, renewable energy systems, and advanced public transportation systems.
- **Community Engagement:** Sustainable urban engineering often involves engaging with local communities and stakeholders to ensure that infrastructure projects align with the needs and desires of the people they serve. This participatory approach can lead to more successful and accepted projects.

BENEFITS

Environmental Benefits:

- **Improved Air Quality:** Green infrastructure helps reduce air pollution and promotes cleaner, healthier air for residents.
- **Enhanced Water Quality:** Natural vegetation and green spaces filter pollutants, improving the quality of local water bodies.
- **Biodiversity Conservation:** Green infrastructure supports native plants and wildlife, preserving local ecosystems.
- **Climate Change Mitigation:** Green solutions can mitigate the urban heat island effect and reduce greenhouse gas emissions.

Economic Benefits:

- **Cost Savings:** Green infrastructure typically has lower maintenance costs compared to traditional concrete-based infrastructure.
- **Property Value Increase:** Investments in green spaces and sustainable development often lead to increased property values.
- **Job Creation:** Green infrastructure projects create employment opportunities in design, construction, and maintenance.

Social Benefits:

- **Improved Public Health:** Cleaner air, reduced pollution, and access to green spaces contribute to better public health outcomes.
- **Recreational Opportunities:** Green areas provide places for community gatherings, outdoor activities, and relaxation.
- **Enhanced Quality of Life:** Green infrastructure contributes to an improved overall quality of life for residents.

Resilience to Climate Change:

- **Flood Mitigation:** Green infrastructure, such as permeable pavements and green roofs, can help manage storm water and reduce flooding risks.
- **Heat Island Reduction:** Green spaces and tree canopies mitigate the urban heat island effect, making cities more resilient to heatwaves.

Community Engagement and Social Inclusion:

- **Empowerment:** Involving local communities in green infrastructure projects fosters a sense of ownership and empowerment.
- **Equity:** Green projects can address social inequalities by ensuring that underserved areas benefit from sustainable development.

- **Natural Disaster Resilience:**

- **Protection Against Natural Hazards:** Certain green infrastructure elements, like coastal vegetation and dune systems, provide natural protection against hurricanes and erosion.

Long-Term Sustainability:

- **Resource Conservation:** Green infrastructure promotes responsible use of natural resources, such as water and energy.
- **Adaptation to Changing Conditions:** Sustainable practices ensure urban areas are adaptable to changing environmental and social conditions.

Tourism and Aesthetics:

- **Attractiveness:** Well-designed green spaces and sustainable urban features can make underdeveloped areas more attractive to tourists and investors.

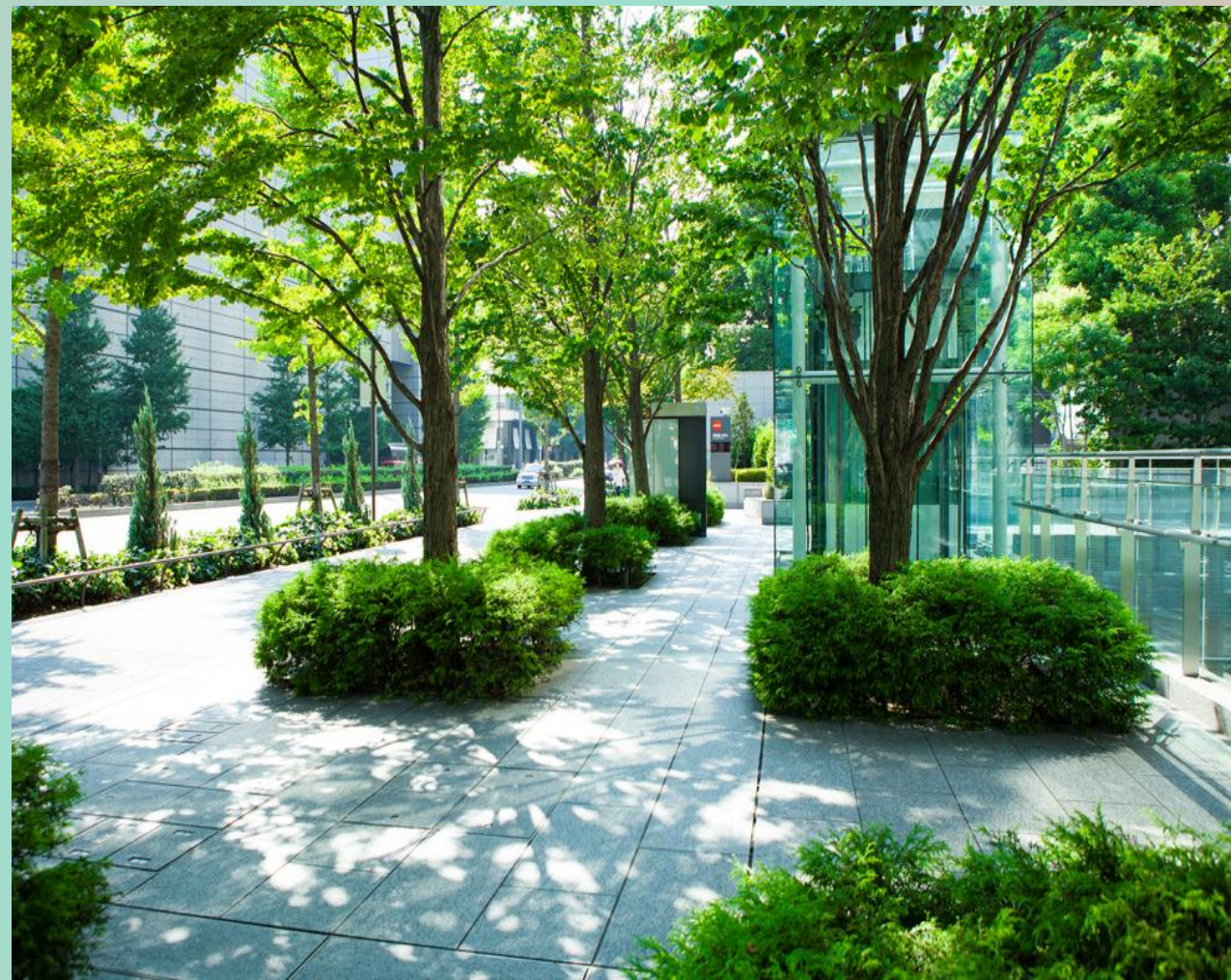
Educational Opportunities:

- **Environmental Education:** Green infrastructure projects can serve as educational tools, raising awareness about environmental issues and sustainable practices.

International Cooperation:

- **Access to Funding:** Green initiatives can open up opportunities for international funding and support from organizations focused on sustainability and development.

AESTHETICS



ISSUES OR CHALLENGES

Limited Financial Resources:

- Insufficient funding and resources available for planning, developing, and maintaining green infrastructure projects.

Lack of Expertise and Technical Capacity:

- A shortage of skilled professionals and technical expertise in sustainable urban planning and green infrastructure design.

Land Use Conflicts:

- Conflicts over land use priorities, as green infrastructure projects may compete with other development needs or interests.

Regulatory Hurdles:

- Navigating complex and sometimes outdated regulations and permitting processes that do not always align with green infrastructure goals.

Public Awareness and Education:

- The need to raise awareness and educate communities about the benefits and importance of green infrastructure.

Environmental Impact Assessment:

- Ensuring that green infrastructure projects do not inadvertently harm local ecosystems or wildlife habitats.

Supply Chain and Material Sourcing:

- Sourcing sustainable materials for green infrastructure projects and ensuring a reliable supply chain.

Institutional Barriers:

- Lack of coordination and collaboration among different government agencies and departments responsible for green infrastructure planning and implementation.

IMPLICATIONS OF GREEN INFRASTRUCTURE FOR URBAN SUSTAINABILITY

- Reduction in air pollution and greenhouse gas emissions
- Improved public health and well-being
- Mitigation of urban heat island effect
- Improved storm water management

SOLUTIONS FOR UNDERDEVELOPED AREAS

- Incorporation of green infrastructure into urban planning
- Engagement of local communities in the planning and implementation of green infrastructure
- Access to funding and resources for green infrastructure projects
- Collaborations between local governments, non-profit organizations, and private entities

WHAT IS JAMAICA'S POSITION

- **National Policy and Strategy:** Jamaica developed a National Policy on Environmental Management (NPEM) that emphasizes sustainable development, including the incorporation of green infrastructure principles. The country has also adopted a National Development Plan, Vision 2030 Jamaica, which includes environmental sustainability as one of its key goals.
- **Climate Change Mitigation and Adaptation:** Jamaica is highly vulnerable to climate change impacts, including sea-level rise, hurricanes, and extreme weather events. The government has recognized the importance of green infrastructure in building resilience to these threats. Projects related to coastal protection, reforestation, and water resource management have been initiated to address climate change challenges.

- **Urban Planning and Sustainable Cities:** Jamaica's urban planning efforts have increasingly incorporated green infrastructure elements to enhance sustainability in cities and urban areas. This includes promoting green spaces, sustainable transportation, and efficient urban design.
- **Biodiversity Conservation:** The Jamaican government has shown commitment to preserving its rich biodiversity and natural habitats. Conservation initiatives and protected areas contribute to maintaining the country's ecological balance.
- **Water Resource Management:** Green infrastructure solutions like watershed management, forest conservation, and reforestation have been integral to Jamaica's efforts to safeguard its water resources, reduce soil erosion, and enhance water quality.

- **Public Awareness and Education:** Public awareness campaigns and educational programs have been used to promote green infrastructure practices among Jamaican citizens, encouraging more sustainable behaviors and practices.
- **International Agreements:** Jamaica has been a signatory to international agreements related to environmental sustainability and climate change, such as the Paris Agreement. This reflects the country's commitment to global efforts to combat climate change and promote green development.
- **Investment and Partnerships:** Jamaica has sought international funding and partnerships to support green infrastructure projects. Collaboration with organizations such as the United Nations Development Programme (UNDP) and the Inter-American Development Bank (IDB) has facilitated the implementation of sustainable development initiatives.

WHAT IS BEING DONE ELSEWHERE?

- Singapore

Singapore's government has implemented policies and regulations that mandate the inclusion of green spaces in urban developments, such as the requirement for rooftop gardens in new buildings. (2009)



• United States

Several cities in the United States have implemented successful green infrastructure projects.

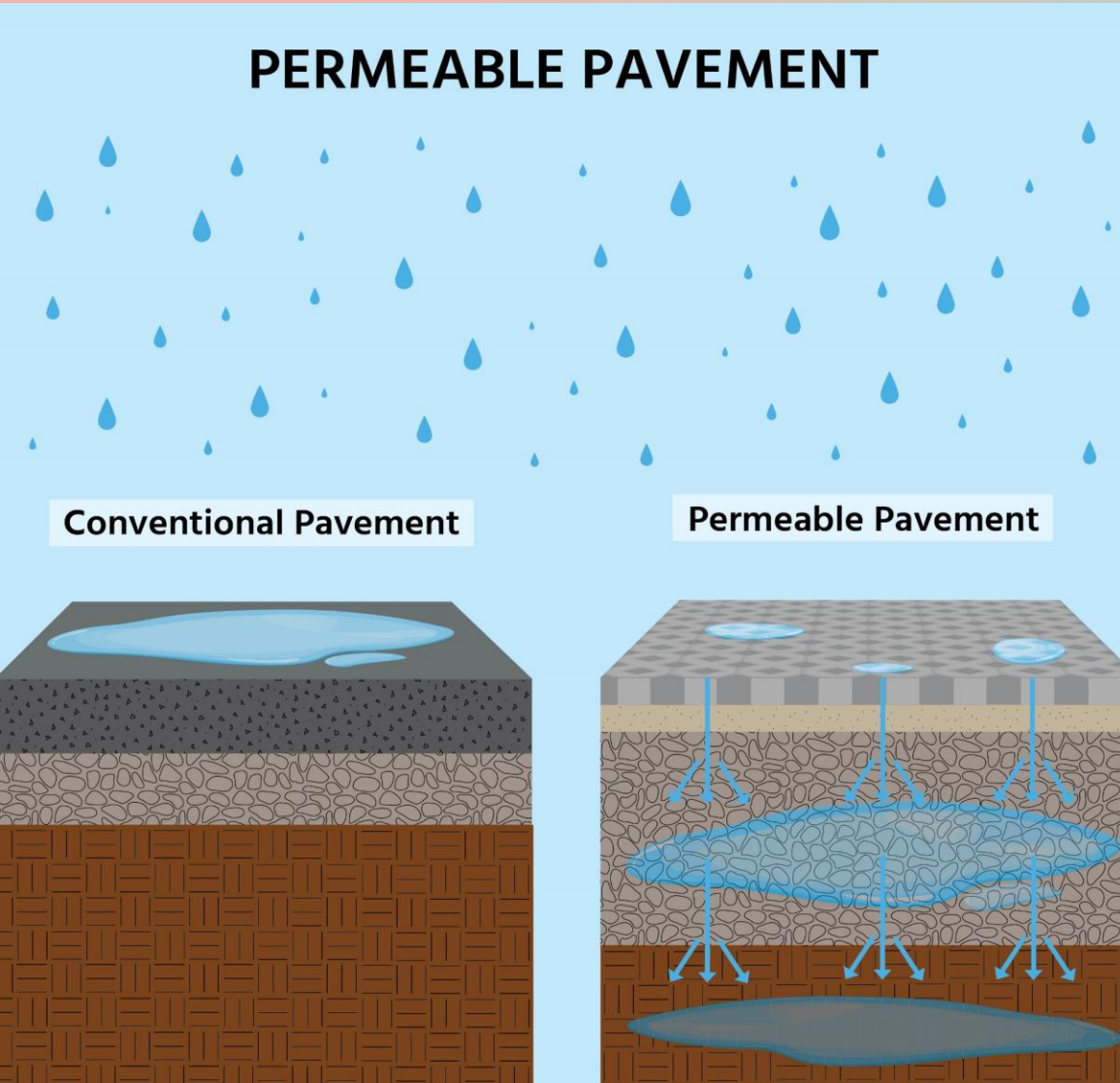
Portland, Oregon, has been a leader in green infrastructure with its extensive network of bios wales, green streets, and eco-roofs designed to manage storm water runoff.



<https://www.arlingtonva.us/Government/Projects/Programs/Stormwater-Projects/Green-Streets>

FLOOD MITIGATION STRATEGY

PERMEABLE PAVEMENT



Somewhere in Jamaica

LESSONS LEARNED AND BEST PRACTICES

- Green infrastructure projects should prioritize local knowledge and practices, taking into account cultural and traditional values.
- Collaboration with governmental bodies, NGOs, and local institutions strengthens the impact and reach of green infrastructure initiatives.
- Green infrastructure projects can address both environmental and social challenges, such as food insecurity and unemployment, in underdeveloped areas.
- Strategic planning and design that considers topography and natural features can optimize the use of available space for green infrastructure.

OPPORTUNITIES

- **Economic Growth:** Investment in green infrastructure projects can stimulate economic growth by creating jobs, supporting local industries, and attracting investment in sustainable technologies and practices.
- **Tourism Enhancement:** Green spaces, parks, and eco-friendly urban design can enhance Jamaica's attractiveness as a tourist destination, drawing eco-conscious travelers and boosting the tourism sector.
- **Disaster Resilience:** Developing green infrastructure, such as natural buffers, resilient buildings, and improved drainage systems, can enhance Jamaica's resilience to natural disasters, reducing the costs associated with recovery and reconstruction.

- **Education and Research:** Establishing research centers and educational programs focused on green infrastructure and sustainability can support capacity-building and knowledge dissemination, attracting students and researchers.
- **Green Technology Innovation:** Opportunities exist for research and development of green technologies and innovations tailored to Jamaica's unique environmental and social challenges.
- **International Collaboration:** Jamaica can engage in international collaborations, knowledge sharing, and partnerships to access technical expertise and support for green infrastructure projects.

CONCLUSION

Green infrastructure helps urban areas adapt to climate change by mitigating the urban heat island effect, reducing flooding through natural storm water management, and providing shade and cooling effects.

-End of Presentation-



Thank You