Report

Disaster Management for Waterlogging in Guwahati City, Assam

Submitted by:
Esha Mandal (B23PH1008)
Lagna Priyadarshini (B23CI1022)
Jeetu Gurjar (B23ME1025)

Supervised by:
Dr. Farhat Naz
Dr. K. J. George

Aim

To address flood management in Guwahati by identifying the main causes of flooding and proposing sustainable solutions, such as rain gardens and bioswales, to reduce surface runoff and improve stormwater management.

Introduction

1. Urbanization in Guwahati: Rapid urban growth has led to significant waterlogging issues, particularly during the monsoon season.
2. Core Problem: Inadequate drainage systems, encroachment on natural water bodies, and uneven topography exacerbate waterlogging.
3. Study Objectives:

- Mapping Flood-Prone Areas: Identify areas most vulnerable to waterlogging.
- Cause Analysis: Determine the primary factors contributing to waterlogging.
- Solution Proposals: Suggest technological and ecological interventions for sustainable urban water management.

4. Goal: To develop practical strategies that can help reduce waterlogging in Guwahati and promote resilient urban development.

Objectives

The objectives of this study are:
1. Analyze Waterlogging Factors: Identify natural and man-made factors that contribute to waterlogging in Guwahati.
2. Map Flood-Prone Areas: Use Geographic Information System (GIS) and other mapping tools to visualize vulnerable zones.

3. Suggest Mitigation Measures: Propose practical, technological, and ecological solutions to manage and reduce the impact of waterlogging.

Study Area

The study focuses on the Guwahati Municipal Corporation (GMC) area, situated between 26°5'N to 26°12'N latitudes and 91°34'E to 91°51'E longitudes. According to the 2011 census, the area hosts a population of approximately 957,352 with a density of 4,400 people per km². The city, affected by heavy rains and proximity to the Brahmaputra River, frequently experiences severe flooding and waterlogging. The region's sub-tropical climate and average annual rainfall of 1,695.3 inches also contribute to this recurrent problem.

Key Causes of Waterlogging

Several factors contribute to waterlogging in Guwahati:

1. Undulated Topography: The city's uneven terrain exacerbates water flow issues, especially in central low-lying areas.
2. Natural Drainage Encroachment: Originally functional stormwater channels are now obstructed due to unplanned urban development and illegal constructions, disrupting the natural flow of water.
3. Inadequate Drainage Systems: Existing drainage systems are often shallow, narrow, and blocked by waste, limiting their capacity to manage stormwater effectively.
4. Hill Encroachment and Erosion: Unchecked deforestation and land use changes on surrounding hills lead to landslides and siltation in drainage systems, further impairing water flow.
5. Lack of Pumping Infrastructure: Guwahati lacks an efficient flood water pumping system to redirect excess water to the Brahmaputra, increasing flood risks during heavy rains.

Methodology

We have used data from government and online sources, including topographic maps, historical rainfall data, and flood records, to map vulnerable zones and better understand the flooding patterns. GIS tools were crucial for analyzing spatial data and identifying high-risk areas.

Zone-Wise Mapping of Flood-Prone Areas

Using GIS, the study categorized different areas of Guwahati based on flood susceptibility. This mapping serves as a tool for urban planners to focus efforts on the most vulnerable regions and guide future urban development away from high-risk zones.

Suggested Technological and Ecological Solutions

To address Guwahati's waterlogging challenges, the study recommends the following measures:

1. Enhanced Drainage Systems: Install both surface and subsurface drains to manage rainwater efficiently, redirecting it from susceptible areas to safe discharge points.
2. Hill Conservation: Enforce restrictions on hill cutting and deforestation to prevent soil erosion, which contributes to siltation in drainage systems.
3. Permeable Pavements and Green Roofs: These features allow rainwater to permeate the ground rather than causing surface runoff, thereby reducing pressure on drainage systems.
4. Rainwater Harvesting Systems: Implement storage solutions and recharge pits to facilitate groundwater infiltration, using retention basins and detention ponds to temporarily hold excess rainwater.
5. Community Involvement and Awareness: Involve local communities in water management initiatives to promote sustainable practices, reduce waste, and discourage encroachment on natural drainage channels.

Simple, Cost-Effective Solutions: Rain Gardens and Bioswales

Rain gardens and bioswales are recommended as simple, affordable solutions to manage urban stormwater. Designed to capture, absorb, and filter rainwater, they offer multiple benefits for flood control, pollution reduction, and groundwater recharge. Key steps for implementing these systems include:

- Site Analysis and Design: Assessing the flow of water, soil composition, and estimating runoff to determine suitable locations.
- Construction: Excavating and layering soil with materials like gravel and sand to facilitate filtration.
- Plant Selection: Using native vegetation that thrives in both wet and dry conditions, enhancing water absorption and filtration.
- Ongoing Maintenance: Regular monitoring to ensure efficient drainage and plant health, optimizing system performance as needed.
-

Conclusion

1. Key Problem: Guwahati has major water logging issues that need a complete approach to fix.
2. Approach Needed: Upgrade infrastructure, protect the environment, and involve the community.
3. Benefits: Reduces waterlogging, strengthens the city against future issues, and supports sustainable growth.

4. Suggested Solutions: Use rain gardens and bioswales, which are affordable and can be used in other cities too.
5. Wider Impact: These solutions can help other cities facing similar flooding problems.