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Challenges and Opportunities in Urban Waste and Water Management in Assam: A Guwahati Perspective

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Abstract

Water and waste management problems are becoming more urgent in rapidly urbanizing areas like Guwahati, Assam. Current household practices, public awareness, and infrastructure support that either facilitate or impede waste and water management were evaluated in this case study. A structured online survey was used to gather data from fifty-five respondents in Guwahati, primarily urban youth, using a mixed-methods technique. Although low levels of waste generation were reported, the results show that poor waste disposal techniques and a widespread practice of not separating waste at the household level exist, with little infrastructure and awareness-raising resources to support them. In regard to water management, encouraging findings included the use of dual-flush toilets; however, the uptake of greywater reuse and rainwater harvesting was minimal. It was also noted that the vast majority of participants indicated little or no awareness of the government's current initiatives, which indicates a fundamental gap in communication about government services. This study highlights significant gaps in outreach, municipal services, and incentives for sustainable household practices, which need to be addressed. Overall, this study provides a good baseline for policy development and environmental planning in relation to environmental justice in Assam and more widely for urban ecosystems.

Keywords: Climate resilience, Guwahati, rainwater harvesting, solid waste disposal, urban infrastructure, urban sustainability, waste management, waste segregation, water conservation

INTRODUCTION

This report presents a comprehensive and in-depth analysis of public practices, attitudes, and awareness concerning water and waste management in the state of Assam, with particular emphasis on its rapidly urbanizing regions, especially Guwahati. The objective of the study is to understand not only how individuals and households currently manage their water usage and waste disposal, but also to assess the level of awareness they possess about sustainable practices and government initiatives related to these critical areas [1].

Through a mixed-methods research design that incorporates both quantitative data (such as frequencies, percentages, and averages) and qualitative inputs (such as open-ended responses and local suggestions), this study attempts to provide a holistic understanding of environmental behaviors, infrastructural gaps, and citizen engagement [2]. The focus on urban areas like Guwahati allows for a closer examination of the specific challenges faced by densely populated and economically active regions, where the strain on natural resources and municipal systems is often more pronounced [3].

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The need for effective and sustainable water and waste management systems has never been more urgent. With rapid population growth, increasing consumerism, and climate-induced disruptions, such as erratic rainfall and urban flooding, cities like Guwahati face mounting pressures on water availability and waste processing capacities [4]. These challenges are further compounded by limited public awareness, inconsistent policy enforcement, and infrastructural shortcomings [5]. In addition to seriously endangering public health, irresponsible disposal practices, such as the open dumping of trash in public spaces, sewers, or adjacent natural water bodies, also contribute to environmental deterioration and water contamination. Stagnant garbage can result in mosquito infestations and related illnesses during the monsoon season, highlighting the vital need for efficient waste and water management [6].

Inadequate municipal capacity, low household segregation rates, and reliance on unhygienic disposal techniques, such as open dumping, are prevalent issues highlighted by earlier research conducted throughout South Asia and India [7]. Additionally, research on high-rainfall areas, such as Diphu in Assam, has highlighted the underutilization of rainwater harvesting. By offering a detailed, first-hand evaluation of public behavior, attitudes, and awareness in Guwahati, a rapidly urbanizing region under pressure from both population expansion and climate-induced flooding, this report adds to the literature [8].

This study intends to close a significant gap in the regional literature by focusing on household level practices, especially the dual challenges of waste segregation and water conservation strategies, such as greywater reuse and rainwater harvesting (RWH). This will provide a useful baseline for policy development that is especially suited to the environmental justice and infrastructure requirements of the Assam urban ecosystem [9].

Thus, by highlighting gaps, possibilities, and areas for improvement, this report aims to make a significant contribution to future planning and policymaking, in addition to outlining the current situation based on first-hand survey data. It seeks to be a useful tool for local government officials, environmental advocacy groups, educators, and interested citizens. [10]. This research used a structured survey approach with a digital questionnaire sent using Google Forms to obtain a comprehensive understanding of the water and waste management behaviors of the people in Assam, especially in urban areas such as Guwahati. Owing to its accessibility, ease of dissemination, and effectiveness in gathering both quantitative and qualitative data – particularly from younger and tech-savvy populations – this methodology was selected [11].

RESEARCH METHODOLOGY

Tool Used

The primary research instrument was a Google Forms online survey, which allowed for wide and convenient dissemination. Respondents could access the survey on their smartphones, tablets, or computers, encouraging participation from a diverse set of individuals despite geographic or time constraints. The use of this tool also enabled automatic data compilation and exportation, facilitating seamless data analysis [12].

Sample Size

A total of 55 individuals participated in the survey. Although this is a modest sample size, it provided sufficient data to identify trends and attitudes, particularly among urban youth. This exploratory sample offers valuable insights and serves as a foundation for more large-scale studies in the future [13].

Demographic Profile of Respondents

The survey targeted a broad audience; however, responses were largely concentrated among young adults aged 19 to 24 years, reflecting a demographic that is both active online and increasingly concerned with environmental issues [14]. A significant 89% of respondents identified as students, representing a population segment that is generally aware of sustainability topics due to educational exposure but may lack practical application opportunities.

The survey also captured information about residential locations:

- 82% resided in urban areas, primarily Guwahati.
- 18% were from rural areas, offering a small but valuable contrast in responses and experiences.

This demographic composition highlights the knowledge gaps, behavioral patterns, and infrastructural differences between urban and rural populations.

Data Types Collected

- *The questionnaire included both* closed-ended (quantitative) questions to capture specific, measurable information such as frequency of waste disposal, availability of water-saving fixtures, and awareness of environmental programs. Response options included multiple-choice, rating scales, and checkboxes [15].
- *Open-ended (qualitative) questions:* These aimed to gather detailed personal views, suggestions, and anecdotal experiences related to water and waste management, offering depth and context beyond numerical data [16].

Analysis Approach

A mixed-methods approach was used for analyzing the collected data.

Quantitative Analysis

Structured responses were compiled and assessed using descriptive statistics. This included calculating percentages, frequencies, and general trends to understand common behaviors and infrastructural patterns related to waste disposal and water use [17].

Qualitative Analysis

Responses to open-ended questions were analyzed using thematic content analysis. Key themes and recurring ideas were identified, such as public dissatisfaction with local waste services, suggestions for awareness programs, and concerns about flooding and drainage. This analysis provided context and emotion behind the numbers, enriching the overall findings [18].

This methodological framework allowed for a balanced and comprehensive evaluation of both what people are doing and why they are doing it. By combining objective data with subjective perspectives, the study was able to uncover actionable insights for policymakers, educators, and community organizers working toward sustainable urban development [19].

Geographic Distribution

- *Urban Respondents:* A significant 82% of the participants resided in urban areas, with the majority from Guwahati city. This urban-centric representation is valuable because cities often face the most acute challenges related to water scarcity, inefficient drainage systems, and solid waste mismanagement due to high population density and rapid growth [20]. Urban residents are also more likely to interact with formal waste collection services and municipal infrastructure, making their feedback particularly relevant for local governance and policy design. Although the survey captured the general urban perspective, future work should strive for precise spatial mapping across different zones of Guwahati [21] (Figure 1).
- *Rural Respondents:* The remaining 18% were from rural regions, offering a comparative lens through which urban and rural differences could be observed. Although fewer in number, rural responses brought attention to localized issues such as a lack of formal waste collection, dependence on traditional water sources, and limited awareness of state-level programs [22].

Summary Interpretation

- This demographic profile reveals that the survey data primarily captures the voices of young, educated, and urban-dwelling individuals in Assam. Their inputs are crucial for two reasons: first, they represent the current and future generation of environmentally responsible citizens,

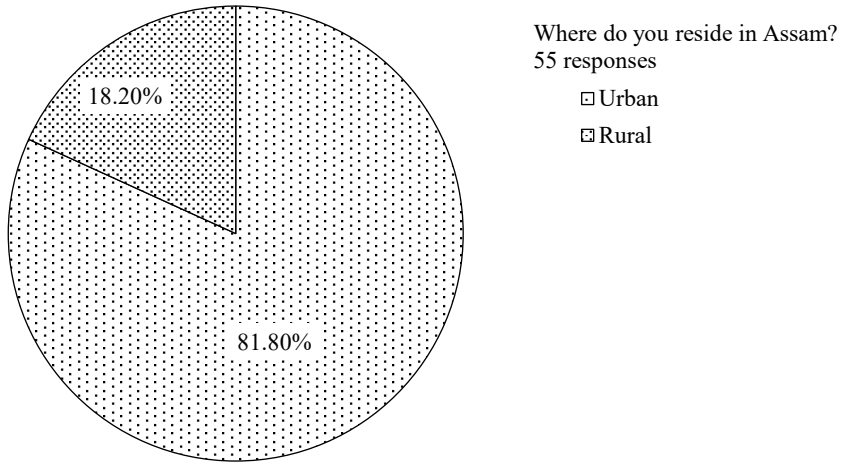

Figure 1. Demographic representation.

and second, they can act as catalysts for spreading awareness and initiating sustainable change within their families and communities [23]. However, this also implies that the study may be less reflective of older age groups or economically disadvantaged populations, whose experiences with water and waste management could differ significantly [24].

Limitations and Future Scope

Although this exploratory study offers a useful baseline, there are a number of limitations that need to be noted. Focus on Demographics and Sample Size: The statistical generalizability of the results is constrained by the small sample size (n = 55). Additionally, 89% of the respondents were urban adolescents and students between the ages of 19 and 24, which introduced demographic bias. Their experiences and understanding of sustainability might not accurately represent the varied perspectives, lack of infrastructure, or resource limitations that older age groups or economically disadvantaged populations must deal with [25].

Contribution of Future Larger-Scale Studies

Future studies should use a larger sample size and a stratified sampling technique to guarantee demographic representation (age, income, and occupation) in both urban and rural contexts to overcome these constraints [26]. To confirm self-reported practices and enhance data dependability, large-scale research should incorporate field observations and in-person interviews. These initiatives would provide a more solid and statistically generalizable foundation for policy in Assam and the surrounding area by enabling inferential statistical analysis, which goes beyond descriptive statistics, to ascertain the statistical significance of factors (such as infrastructure availability and awareness) influencing sustainable household practices.

THEORETICAL FRAMEWORK

Future studies should use a larger sample size and a stratified sampling technique to guarantee demographic representation (age, income, and occupation) in both urban and rural contexts to overcome these constraints. To confirm self-reported practices and enhance data dependability, large-scale research should incorporate field observations and in-person interviews. These initiatives would provide a more solid and statistically generalizable foundation for policy in Assam and the surrounding area by enabling inferential statistical analysis, which goes beyond descriptive statistics, to ascertain the statistical significance of factors (such as infrastructure availability and awareness) influencing sustainable household practices [27].

Sustainable Urban Metabolism

According to the sustainable urban metabolism (SUM) framework, Guwahati is a dynamic living system that produces outputs (such as solid waste and wastewater) and consumes resources (such as

food, water, and materials). A circular model that prioritizes reduction, reuse, and recycling replaces the linear "take-make-dispose" paradigm in a sustainable system [28].

Application to Findings

According to the statistics, Guwahati's metabolism is still mostly linear. Despite the fact that 45.5% of waste is recyclable and 38% of waste is organic, these materials are rarely separated or reused, indicating a significant loss in potential resource recovery. Natural resource loops are only partially active, as evidenced by the fact that 70.9% of respondents do not reuse greywater and 63.6% do not collect rainwater [29].

This inefficiency is a reflection of institutional and infrastructure constraints that impede circularity, such as inadequate waste segregation systems, lax policy enforcement, and poor public engagement [30].

Integrated planning is crucial for shifting toward a sustainable metabolism. This involves connecting waste-to-energy initiatives with municipal networks, offering decentralized composting units, and offering incentives for RWH. To integrate Guwahati's development objectives with larger North-Eastern urban ecosystems that have comparable climatic and infrastructural difficulties, a more robust regional framework is also required [31].

Future Larger-Scale Studies

Larger samples from wards in Guwahati and neighboring towns, such as North Guwahati, Sonapur, and Boko, could be used in future research to measure material and water movements geographically and to produce data for modelling urban metabolism. In addition to addressing any sampling bias in the present youth-dominated dataset, such a study would produce robust, broadly applicable results that could be applied to other flood-prone cities in the Brahmaputra valley [32].

Theory of Planned Behavior

The theory of planned behavior (TPB) explains how individuals' intentions translate or fail to translate into actual behavior (Table 1). It identifies three core determinants of behavioral intention: attitude, subjective norms, and perceived behavioral control (PBC) [33].

Interpretation

Despite the research population's significant favorable views towards sustainability, these intentions cannot materialize into consistent activities because of the low PBC caused by inadequate infrastructure and low municipal engagement. Without visible public norms and supportive structures, behavioral intention is insufficient on its own [34].

Table 1. These factors were directly reflected in respondents' answers.

TPB component	Definition	Link to study findings
Attitude	The individual's positive or negative feelings toward performing the behavior.	Respondents showed a generally positive attitude, with 76.4% indicating a willingness to participate in waste management initiatives.
Subjective Norms	The perceived social pressure to engage or not engage in the behavior.	This factor is low due to an obvious lack of community consensus and government visibility, with 89.1% unaware of government initiatives.
Perceived behavioral control (PBC)	The perceived ease or difficulty of performing the behavior is linked to the availability of necessary resources and opportunities.	This is the critical gap. The majority cited infrastructure (52.7%) and resources (47.3%) as major challenges. The widespread practice of not segregating waste is directly attributable to low PBC, i.e., the absence of segregated bins or reliable municipal collection systems.

Policy Implications and Theoretical Integration: Integrating TPB and SUM emphasizes the need for concurrent systemic reform and behavioral change. While social norms influence residents' desire to engage in waste segregation and water conservation, infrastructure (a SUM concern) directly influences PBC (a TPB concern). Therefore, policymakers should develop social infrastructure in addition to physical infrastructure through raising awareness, offering incentives, and implementing participatory programs [35].

Theoretical Contribution and Future Research Scope

This integrated theoretical approach advances a multidimensional paradigm for comprehending urban sustainability in medium-sized Indian cities. While TPB captures the human aspect of sustainability attitudes, norms, and perceived control, SUM places Guwahati in the context of its resource metabolism.

However, the results are susceptible to sampling and demographic bias because this was an exploratory, small sample study (n=55) that largely represented urban adolescents (aged 19–24). A stratified sample should be used in future larger-scale mixed-method research to include a variety of age groups, professions, and income levels within all city zones. Combining focus groups, ethnographic observations, and spatial mapping would validate behavioral data and produce thorough, cross-sectional evidence [36].

By providing reproducible models for other North-Eastern towns facing comparable climatic, infrastructural, and social restrictions, such research could enhance Guwahati's standing as a regional case study for sustainable urban transitions [37].

RESULTS AND DISCUSSIONS

Waste Management Analysis

In fast-growing areas such as Assam, where urbanization is drastically altering the relationship between inhabitants and their surroundings, efficient waste management is essential for sustainable urban development. This chapter provides a thorough evaluation of the respondents' household solid waste management methods, their knowledge of local trash disposal systems, and the opportunities and difficulties associated with enhancing current procedures. The analysis is divided into three main sections: types and amounts of trash produced, disposal techniques, and awareness and segregation practices [38].

Waste Generation and Types

According to the poll, more than 70% of participants produce less than 1 kg of household garbage every day. This comparatively tiny amount is typical of single-person or small-family households, especially for young professionals or students sharing housing. Although the amount may be small, the nature of the waste raises significant environmental issues [39].

The most commonly reported waste category was organic waste, which includes yard trimmings, vegetable peels, and food leftovers. Recyclable materials, such as cardboard, paper, and plastics, came next. Given the high percentage of recyclable and biodegradable materials [40] (Figure 2), it is likely that regional composting and recycling programs can be established.

However, a recurring issue identified in the qualitative responses is the lack of systems or spaces to manage these types of waste properly. While respondents acknowledged that much of their waste could be reused or composted, they often lacked the infrastructure, support, or motivation to do so. In some cases, households reported mixing all waste into a single bin due to a lack of awareness or municipal guidance [41].

This indicates that while the potential for environmentally friendly waste processing exists, it remains largely untapped because of infrastructural and educational gaps [42] (Figure 3).

Disposal Methods

Waste disposal practices varied among respondents; however, the data highlight some troubling trends alongside promising habits. A limited but significant number of households reported engaging in basic recycling or composting, often informally. For instance, some respondents indicated that they separated dry and wet waste or used food waste as compost for home gardens. These practices, although currently unstructured, show a foundational awareness that could be enhanced through proper training and resources [43].

In contrast, the study uncovered a concerning level of improper disposal, including open dumping of garbage in public areas, drains, or nearby natural water bodies. Such practices not only contribute to environmental degradation and water pollution but also pose serious public health risks, especially during the monsoon season, when stagnant waste can lead to waterborne diseases and mosquito infestations [44].

These findings underscore the need for stronger monitoring and enforcement mechanisms. Additionally, the responses highlight the necessity of expanding waste collection services, particularly in semi-urban and rural areas, where official garbage pickup may be irregular or non-existent. While some households reported engaging in basic, informal recycling or composting, the study uncovered a concerning level of improper disposal, including open dumping of garbage. This behavior is often rooted in systemic frustration [45] (Figure 4).

Many respondents expressed uncertainty or dissatisfaction regarding where their waste goes after disposal, indicating a disconnect between households and municipal waste systems. A common sentiment was, "Why should I bother separating my trash when the truck just dumps it all into one pile anyway? The system has no transparency and no accountability" [46]. This lack of faith in the municipal process undermines public participation, even among those with environmental awareness.

Awareness and Segregation Practices

One of the most significant insights from the survey is the limited adoption of waste segregation practices at the household level. Despite being educated and mostly residing in urban areas, a majority of respondents admitted that they do not separate biodegradable waste from recyclable or hazardous materials. This finding points to a deeper systemic gap, as municipal authorities have not provided segregated collection systems or strong community-level outreach [47] (Figures 5 and 6).

This issue is compounded by the lack of awareness of local waste collection services. Approximately 61% of respondents were unaware of the collection schedule or identity of waste collectors, and nearly 18% were unsure whether any organized collection system existed in their area. This ambiguity leads to inconsistent or negligent disposal habits, even among environmentally conscious individuals [48]. Respondents' qualitative feedback provides vivid insight into the challenges:

- "Even if I separate my waste, the collector mixes it all in one truck."
- "We do not know when the garbage vehicle comes; sometimes, it skips for days."
- "There are no colored bins anywhere; how can people segregate when everything goes in one *bin?"*

These comments reveal frustration with the disconnect between citizen efforts and institutional systems.

The following key suggestions emerged from thematic analysis:

- *Awareness and knowledge drives:* Participants emphasized the need for school- and community-based education campaigns. "If schools teach children about waste segregation, they will influence their parents too," one respondent said.
- Provision of color-coded bins: Many participants expressed a willingness to segregate if proper bins were available. "Colored bins make it easier; at least we will know where each type of waste goes," noted one respondent (Figure 7).

- Composting Incentives: Several respondents recommended government or private support for composting, such as small grants or a "green citizen" reward system.
- Overall, while awareness exists, behavioral change is constrained by inadequate infrastructure and institutional engagement. The findings suggest a strong latent willingness to participate in waste segregation, which can be activated through consistent public education, policy incentives, and visible municipal cooperation (Figure 8).

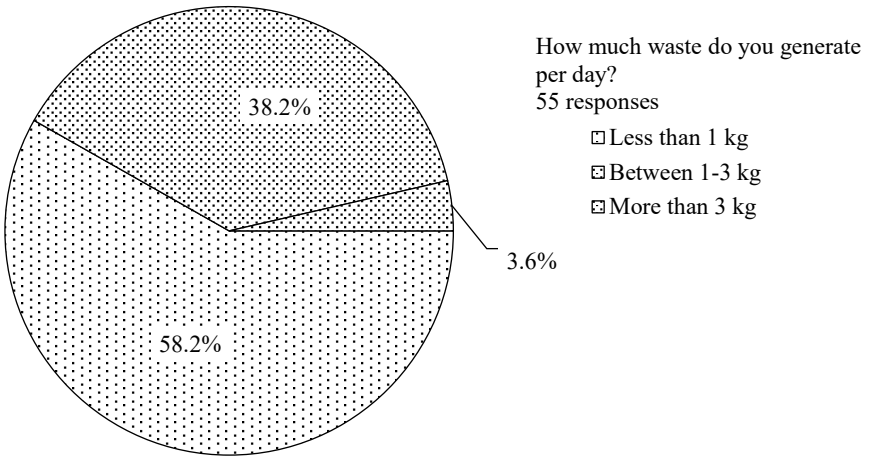

Figure 2. Waste generation per day.

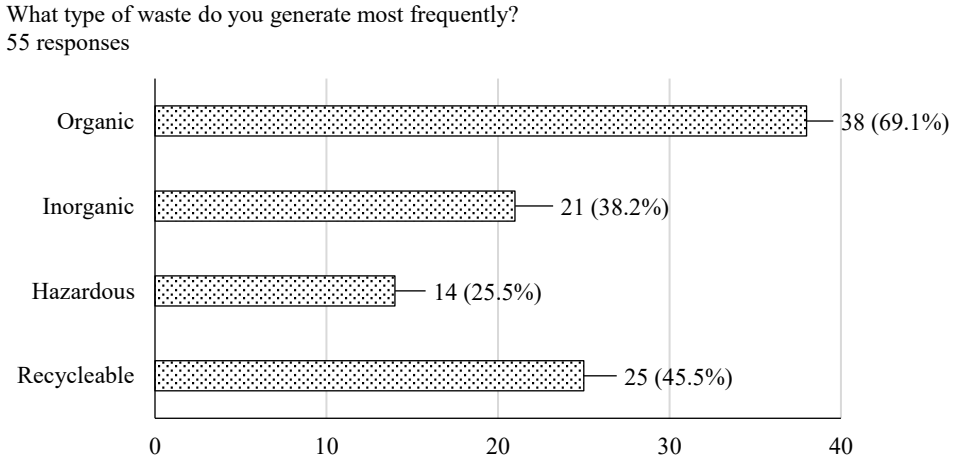

Figure 3. Waste segregation.

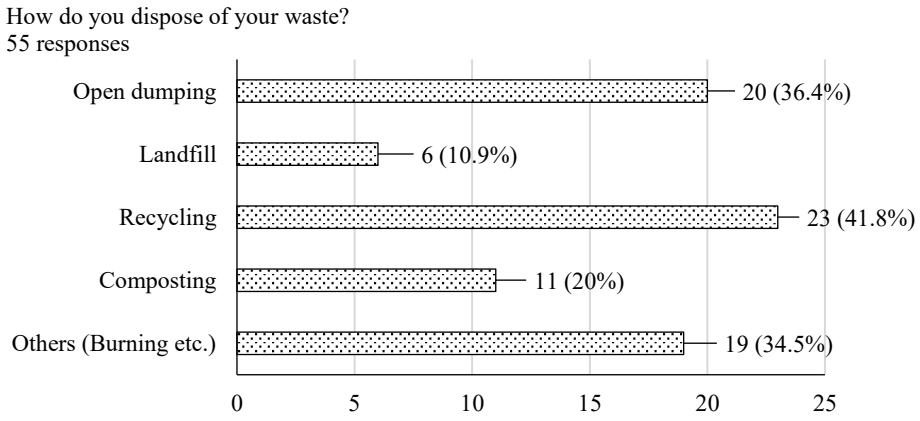

Figure 4. Disposal of waste.

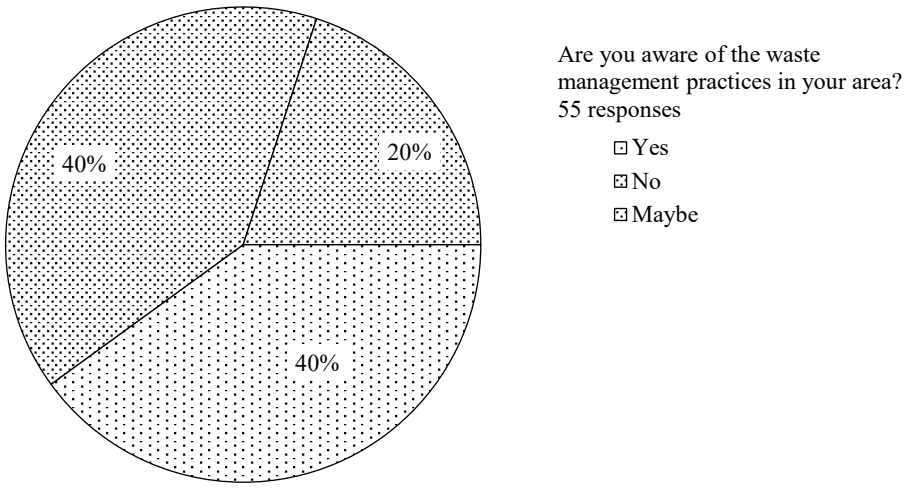

Figure 5. Waste management awareness.

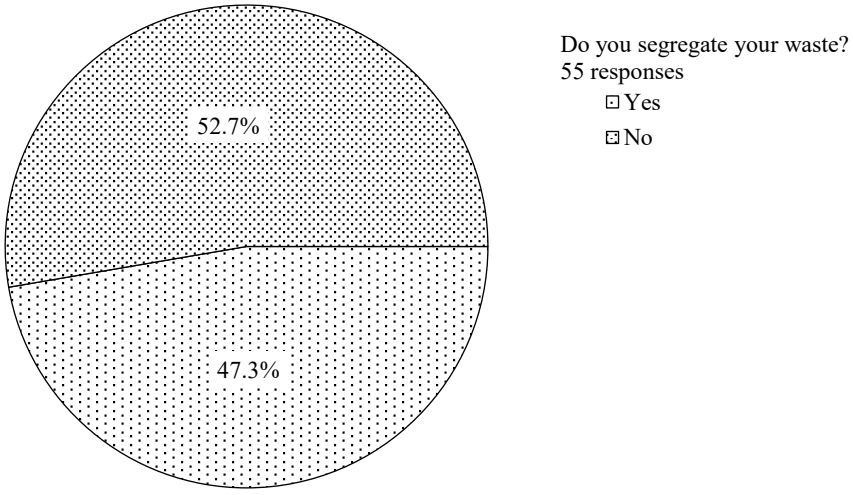

Figure 6. Waste segregation.

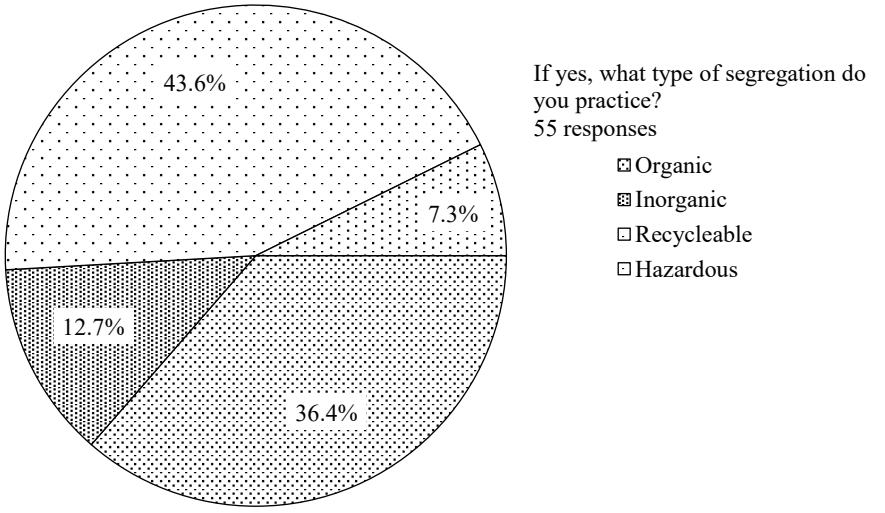

Figure 7. Type of waste segregation.

SUMMARY OF WASTE MANAGEMENT PATTERNS

The analysis presents a mixed scenario in which awareness and intent among urban youth are growing, but actual practices remain weak. Improper disposal, lack of segregation, irregular collection, and minimal public education continue to hinder progress. Nevertheless, clear opportunities exist through the establishment of decentralized composting, segregated bin systems, and incentive-based awareness programs [49] (Figure 9).

Water Management Analysis

Water management is a vital component of sustainable urban planning, particularly in rapidly expanding cities such as Guwahati. The survey gathered data from 55 respondents, 82% of whom were urban and 18% rural, using a 38-question digital questionnaire.

The results highlight household level behaviors, infrastructural gaps, and awareness levels related to water consumption, reuse, and conservation [50] (Figures 10 and 11).

Urban respondents primarily depend on piped municipal water, whereas rural households rely more on borewells. RWH is still rare, although several participants noted growing interest in the practice (Figure 12).

Consumption Patterns

- Most households use water for essential purposes, such as cooking, bathing, and cleaning.
- About 31% of respondents with home gardens use 1–3 liters daily for plants.
- 47% of respondents reported using dual-flush toilets, reducing water wastage.
- A few households reuse greywater from sinks and showers; however, this remains uncommon. As one participant explained, “We would reuse greywater if we had a simple system; it’s not about unwillingness, it’s about not knowing how” [51].

Observation

While access to water sources appears stable, reuse and conservation remain underdeveloped. Greater awareness and low-cost reuse technologies could transform this behavior. Given Assam’s alternating conditions of waterlogging and seasonal scarcity, sustainable water practices are essential for climate resilience (Figures 13 and 14).

Sources of Water and Their Consumption

Respondents rely on multiple sources:

- Municipal supply (piped water): 72%
- Groundwater via borewells/tube wells: 20%
- Rainwater collection/storage: 6%
- Surface water (rivers or ponds): 2%

Consumption Patterns

When asked about daily water consumption:

- Most households reported using water for basic domestic purposes, such as drinking, cooking, bathing, and gardening.
- Respondents who had flowerpots or small gardens reported using approximately 1–3 L of water per day specifically for plant care [52].
- Dual-flush systems in washrooms were observed in many homes, which play a significant role in reducing unnecessary water wastage (Figure 15).

A portion of the respondents indicated that they reused greywater–wastewater from sinks, showers, and basins–for secondary purposes, such as flushing toilets or irrigating gardens. However, this practice was not widespread, suggesting a need for greater awareness and infrastructure to support water recycling at the household level (Figure 16).

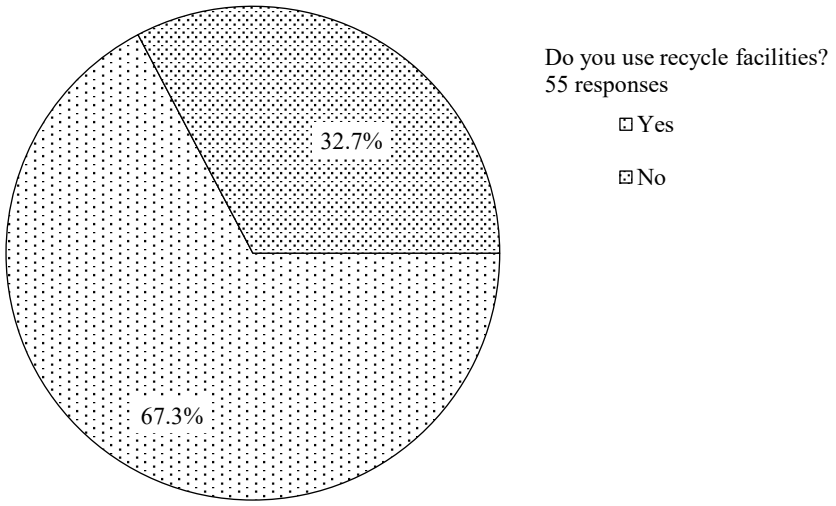

Figure 8. Recycling facilities.

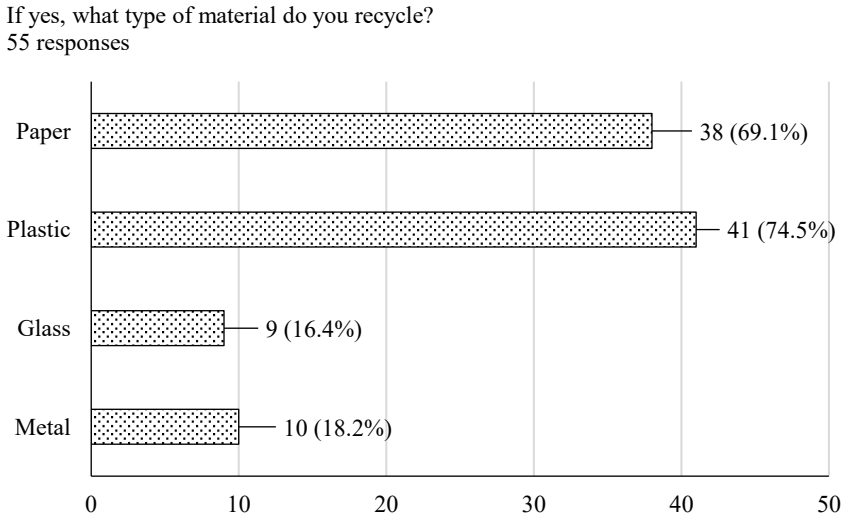

Figure 9. Segregation of recycling materials.

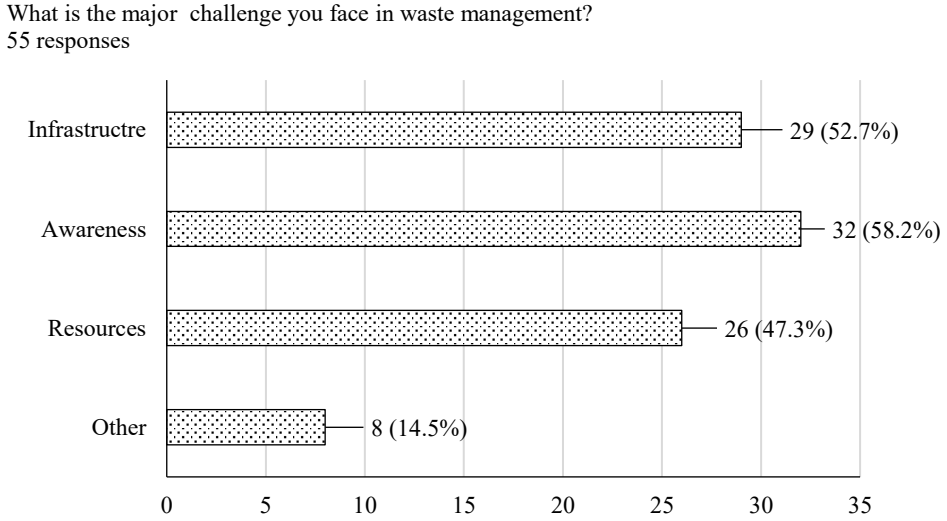

Figure 10. Challenges in waste management.

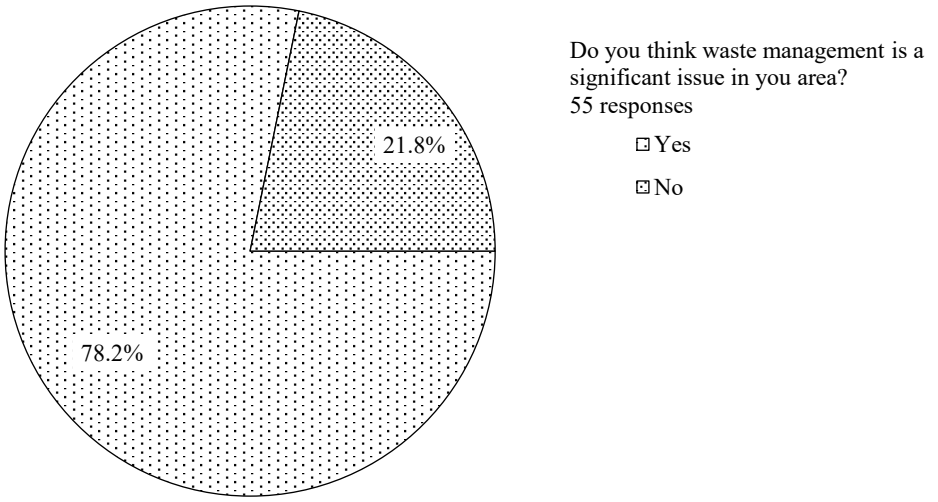

Figure 11. Significance of waste management.

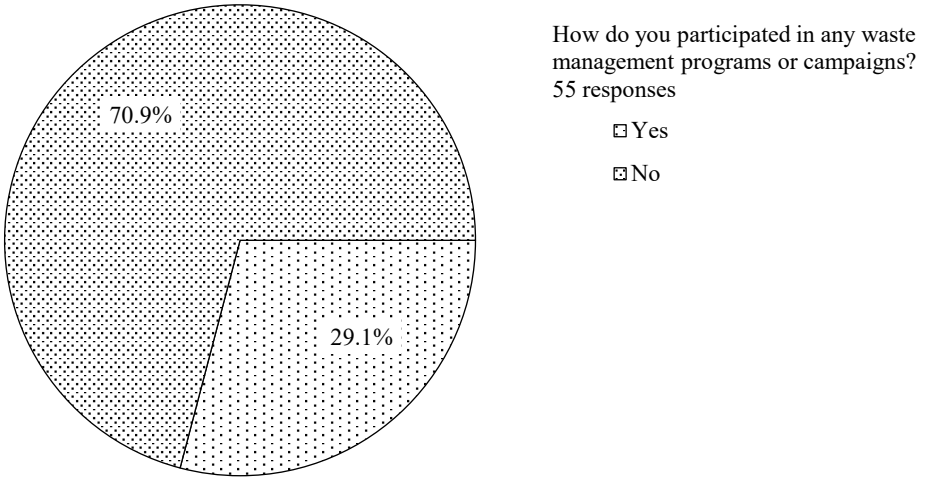

Figure 12. Waste management programs.

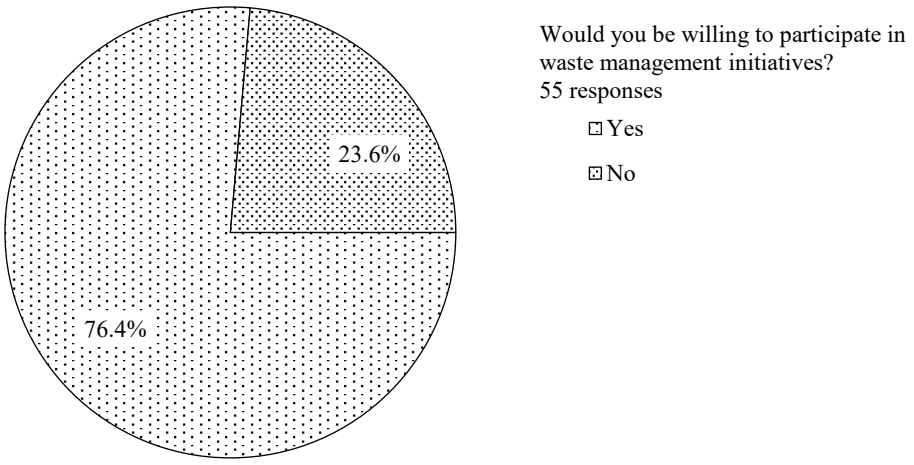

Figure 13. Waste management initiatives.

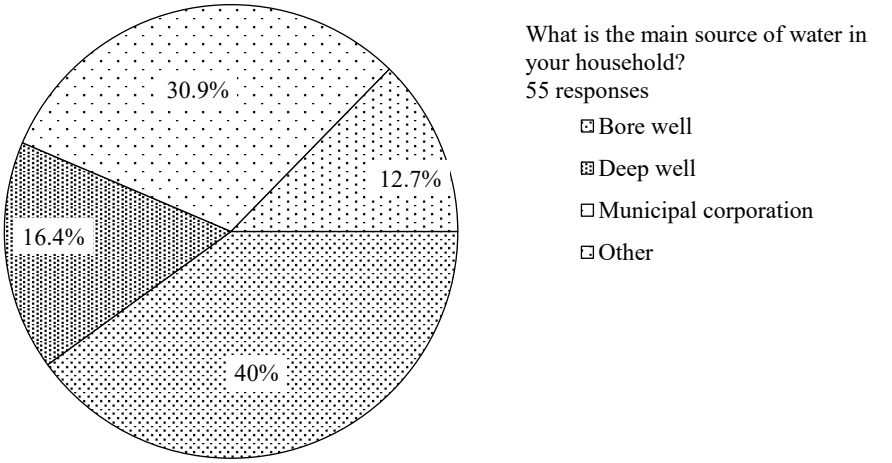

Figure 14. Sources of water.

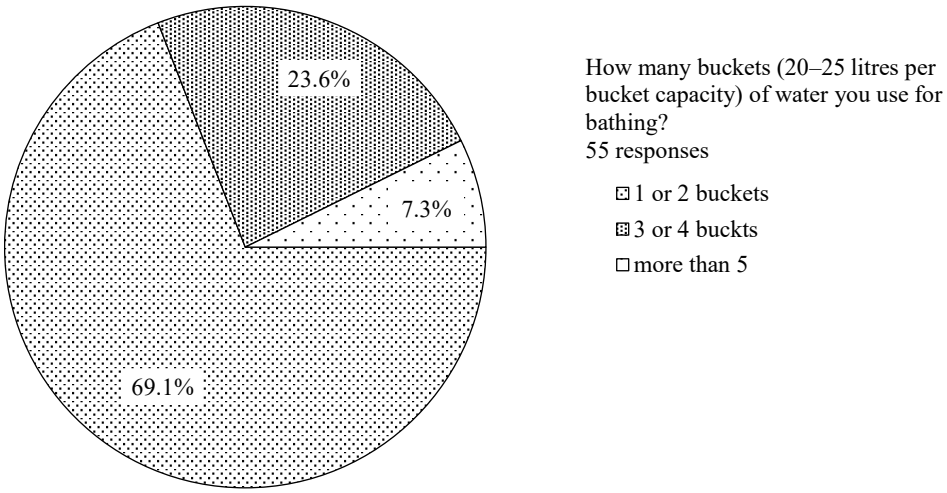

Figure 15. Sources of water.

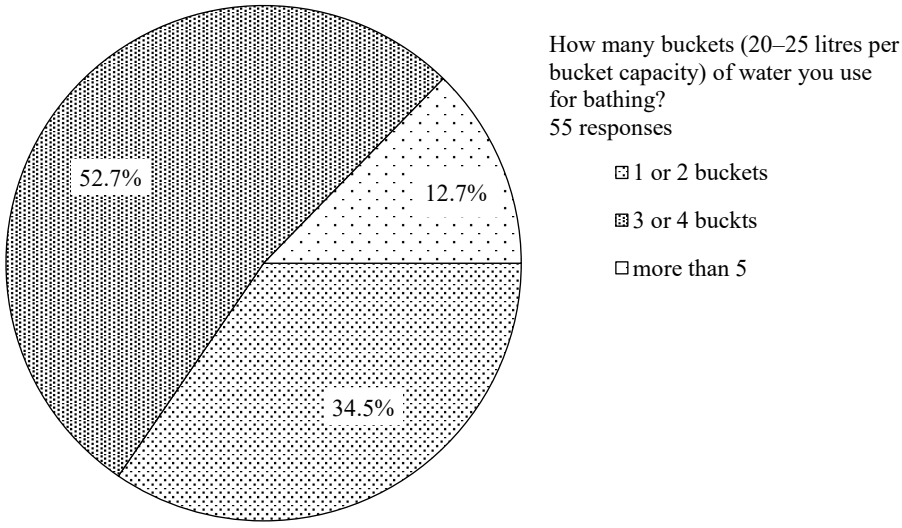

Figure 16. Water consumption for washing clothes.

Observations and Implications

The findings suggest that while access to primary water sources is relatively stable, the conservation and reuse of water remain underutilized. The use of water-saving technologies, such as dual-flush toilets, is a positive sign; however, RWH and greywater reuse are areas that require attention [53] (Figure 17).

Public awareness campaigns, combined with community incentives for installing water-saving infrastructure, can significantly enhance water sustainability. As Assam faces periodic flooding and water stress, integrating these practices into everyday life is crucial for building long-term resilience.

Water Management Techniques

The data indicate that households are ready to adopt simple water-saving infrastructure when it is affordable and easy to install. Practices observed include:

- *Use of dual-flush systems:* Adopted by nearly half of the respondents, indicating the potential for mainstreaming efficient fixtures.
- *Water use for gardening:* Daily outdoor use is modest but could be optimized through greywater reuse. *"*We could water our plants with wash-basin water if there was an easy way," said one respondent.
- *Greywater reuse:* Only 29% of respondents reuse greywater, mostly for garden irrigation. Barriers to greywater reuse include the lack of treatment systems, hygiene concerns, and no institutional guidance. This represents a missed opportunity for conservation.
- *Rainwater harvesting:* Practiced by 36% of respondents despite Assam's high rainfall. This represents a major untapped resource.

Respondents Suggestion

- Community-level storage tanks in apartment complexes.
- Subsidies for household rooftop systems.

Implication

Promoting small-scale, low-cost technologies through community programs could drastically reduce freshwater demand and improve resilience to floods and droughts (Figures 18, 19).

WATER USE FOR GARDENING AND PLANTERS

Respondents with planters or flowerpots reported daily water usage in the range of 1–3 liters, suggesting modest outdoor water consumption. While this figure is low, it reflects a routine that could be optimized further through greywater reuse or the collection of rainwater for irrigation (Figure 20).

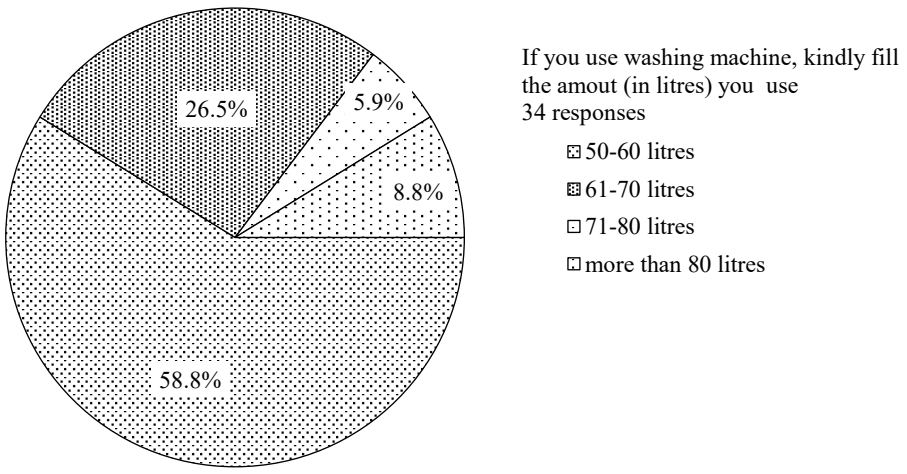

Figure 17. Water consumption by washing machines.

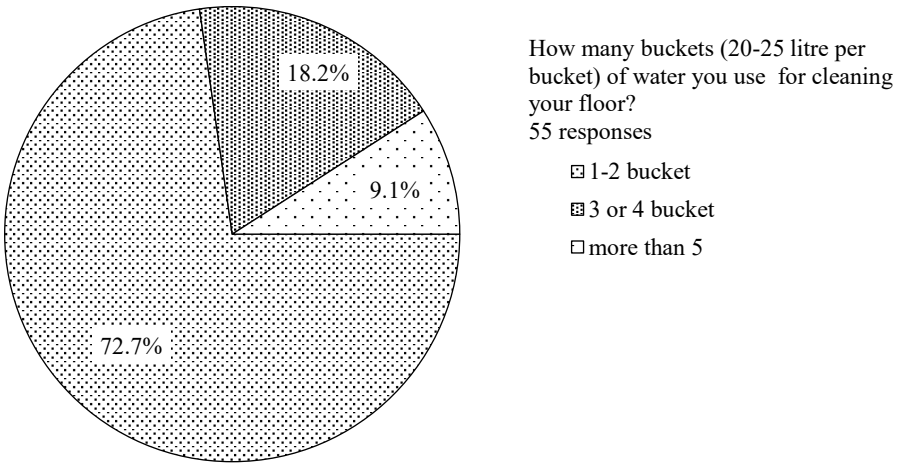

Figure 18. Water consumption for cleaning clothes.

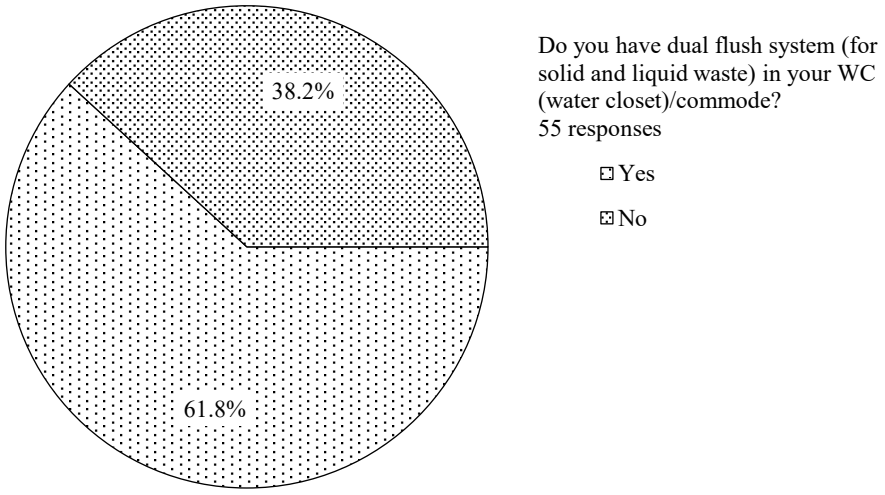

Figure 19. Use of a dual-flush system.

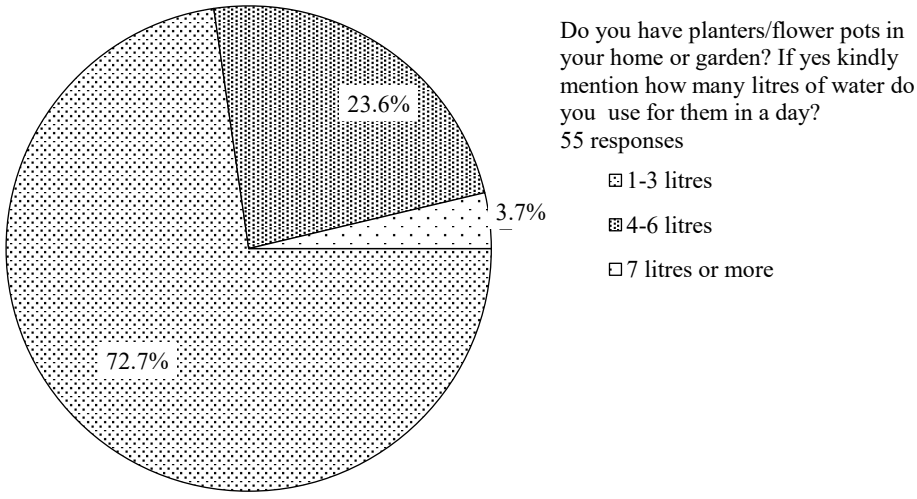

Figure 20. Water consumption for the garden.

WATER-RELATED CHALLENGES AND GOVERNMENT AWARENESS

Some households indicated that they reused greywater (from wash basins, kitchen sinks, and bathrooms). However, this was not common practice. The limited uptake may be due to:

- Lack of household treatment systems
- Perceived hygiene concerns
- Absence of policy or infrastructure support
- Observation:
- Greywater reuse remains a missed opportunity in residential water conservation.

RAINWATER HARVESTING

A small but significant group reported practicing RWH or collection. Given Assam's high rainfall, this presents a major opportunity for sustainable water sourcing. However, the adoption rate suggests that RWH is not yet mainstream (Figure 21).

Recommendations:

- Promote RWH through community programs and government incentives.
- Educate households on low-cost setup methods and maintenance.

Most respondents reported at least one water-related issue – either inconsistent supply, flooding, or poor drainage. Yet nearly 89% were unaware of state or city-level water initiatives such as Jal Jeevan Mission or Smart City water projects. This indicates a critical communication gap (Figure 22).

Key takeaways:

- Water-saving devices exist, but are not universal.
- Greywater reuse and RWH are underutilized despite strong potential.
- Public awareness of government initiatives is minimal.

"We hear about new schemes on social media, but no one tells us how to apply them locally," one participant commented.

Closing this gap requires stronger government visibility, localized outreach, and citizen participation (Figure 23).

Water-Related Challenges and Government Awareness

Guwahati's water crisis is a prime illustration of "Plenty yet not enough." The majority of the city's 1.5 million residents rely on unregulated private borewells due to the severe scarcity of quality piped water, despite the presence of the Brahmaputra River. This dependence has led to critical groundwater depletion, and in many areas, the silent threat of arsenic, fluoride, and excessive iron contamination poses significant long-term health risks to the metropolitan population. Furthermore, the government

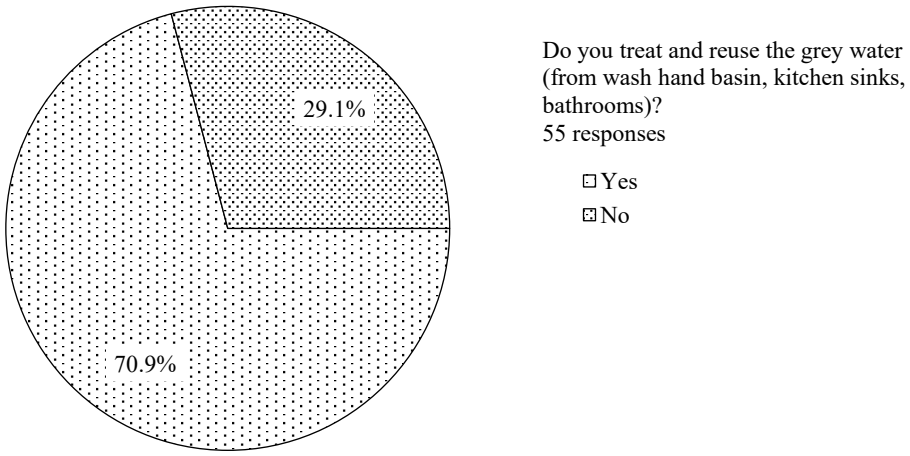

Figure 21. Treatment of grey water.

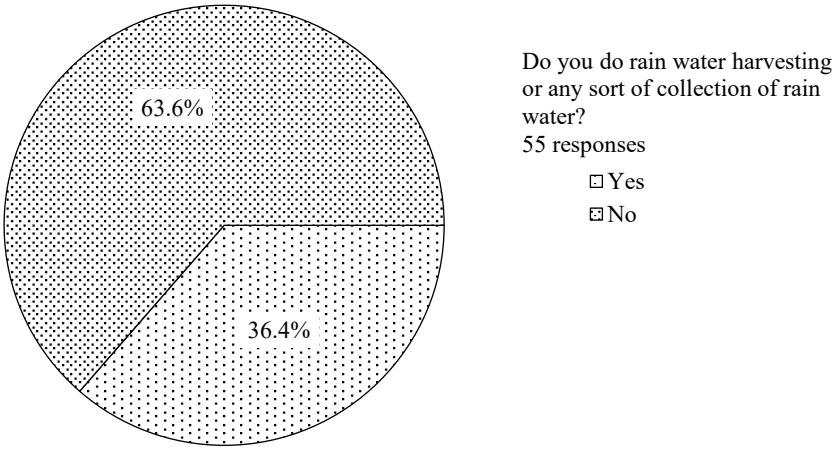

Figure 22. Collection of water through rainwater harvesting.

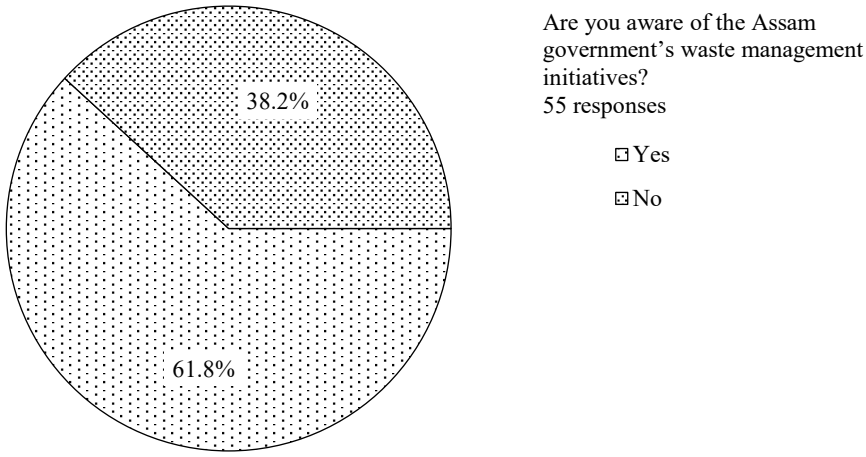

Figure 23. Awareness of Assam government waste management initiatives.

has launched the "Mission Flood-Free Guwahati," demonstrating high-level recognition of the economic costs associated with urban flooding. This awareness is reflected in measures such as extensive desiltation programs and challenging eviction processes aimed at restoring encroached wetlands.

Government Practices and Policies

Water management is a key concern in Assam, where challenges, such as seasonal flooding, limited infrastructure, and an uneven water supply, persist. Survey data reveal public perspectives on governmental involvement in water management, offering a useful gauge of awareness, satisfaction, and engagement with official policies.

Awareness of Government Water Management Initiatives

A major finding from the survey is the low level of public awareness regarding government-led water management initiatives. When asked about existing water conservation or distribution policies, most respondents were either:

- Unaware of any such initiatives,
- Unable to recall specific programs or departments involved,
- Or skeptical about their effectiveness.

This lack of awareness suggests a communication gap between the government and the public. Despite the likely presence of water schemes (e.g., Jal Jeevan Mission or city-level RWH mandates), the outreach and visibility of these initiatives appear to be limited.

Perception of Government Efforts in Flood Management

Flooding, particularly in urban areas such as Guwahati, is a recurring concern among respondents. Although this is directly related to drainage and surface water control, it is closely linked to broader water management issues.

Respondents highlighted flood-prone areas such as:

- Chandmari
- Ganeshguri
- Zoo Road
- Hatigaon

Despite recognizing these risks, many indicated that government efforts to manage stormwater or urban flooding were unclear, insufficient, or inconsistently executed. The absence of visible mitigation, such as improved drainage systems, retention basins, or flood warnings, has led to diminished public trust in official responses.

Lack of Incentives or Programs for Household Level Water Conservation

The data also suggest that very few households receive direct support or guidance from local authorities on water-saving techniques, such as:

- Greywater reuse,
- Rainwater harvesting, or
- Installation of water-efficient fixtures.

This highlights a policy blind spot in which decentralized, community-level water management practices are under-supported. While some respondents reported personal efforts (e.g., using dual-flush systems), these actions appear to be individual choices rather than responses to government campaigns or incentives.

Public Suggestions for Government Improvement

Survey participants offered practical suggestions that reflected both an awareness of the problem and expectations of government leadership.

- Launch public campaigns about water-saving practices.
- Promote RWH through subsidies or awareness drives.
- Implement early warning systems and waterlogging maps in flood-prone zones.
- Ensure transparent and consistent communication about ongoing water-related infrastructure projects.

The survey reveals a clear disconnect between the public and the government regarding water management in Assam. While issues such as urban flooding and water conservation are recognized by citizens, awareness of governmental action is minimal. To close this gap, it is essential for authorities to:

- Make policies more visible and accessible,
- Engage communities through education and incentives,
- Provide transparent updates on infrastructure developments.

CONCLUSION AND PRIORITIZED RECOMMENDATIONS

The study of 55 respondents across Guwahati and surrounding areas provides an exploratory but insightful picture of waste and water management behaviors.

While most households generate less than 1 kg of waste per day (58%), only 47% segregated waste, and improper disposal methods remain prevalent. Similarly, 70% do not reuse greywater, and only 36% practice RWH. These behaviors reflect infrastructural, educational, and institutional shortcomings rather than unwillingness.

To translate positive intentions into sustained behavior, policymakers should adopt a prioritized, stepwise implementation approach:

Step 1. Immediate (0–1 Year)

- *Awareness campaigns:* Launch school and community programs on waste segregation, composting, and water reuse.
- *Transparent information:* Publicize municipal collection schedules and contact details through ward offices and mobile applications.
- *Health emphasis:* Highlight how improper disposal contributes to mosquito-borne and waterborne diseases to create a sense of urgency.

Step 2. Intermediate (1–3 Years)

- *Infrastructure provision:* Distribute color-coded bins, establish decentralized composting units, and create community rainwater storage systems.
- *Capacity building:* Training waste collection staff and local volunteers in segregation and recycling practices.

Step 3. Long-Term (3–5 Years)

- *Incentive-based programs:* Introduce "Green Citizen" recognition, tax rebates, or utility discounts for sustainable households.
- *Policy integration:* Align city programs with the Smart City and Jal Jeevan Mission frameworks for continuity and funding.

Acknowledged Limitations and Future Scope

As an exploratory study with a small, youth-dominant sample (n = 55), the findings are indicative rather than representative. Future research should employ stratified sampling to include varied age, income, and geographic groups. Larger datasets could support inferential analysis to establish statistically significant relationships between awareness, infrastructure, and behavior. Comparative studies with other North-Eastern cities, such as Shillong, Dibrugarh, and Aizawl, can help build a regional sustainable urban management framework.

In summary, this study underscores that awareness without infrastructure leads to stagnation, whereas infrastructure without awareness leads to misuse. Combining both through phased, participatory governance can enable Guwahati and Assam to progress toward an equitable, circular, and climate-resilient urban future.

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