Green Audit Report (2023-2024)

TRIPURA UNIVERSITY
(A Central University)
SURYAMANINAGAR – 799022,
TRIPURA, INDIA

प्रो. गंगा प्रसाद प्रसाईं
कुलपति

Prof. Ganga Prasad Prasain
Vice-Chancellor

त्रिपुरा विश्वविद्यालय
(केन्द्रीय विश्वविद्यालय)
सूर्यमणिनगर–799022, त्रिपुरा, भारत
TRIPURA UNIVERSITY
(A Central University)
Suryamaninagar-799022, Tripura, India

No.F.TU/VCS/MISC/01/2022 Date: 27th January, 2025

Foreword from Vice Chancellor

It is with immense pride and responsibility that I introduce the Green/Energy/Environmental Audit Report 2023-24, which mark a transformative step in our institution's commitment to sustainability. This reports represent a comprehensive evaluation of our practices, reflecting our dedication to fostering an environmentally conscious campus and paving the way for a more sustainable future.

In today's world, where global challenges demand collective action, the report embody our commitment to transparency, accountability, and innovation. It serve as a testament to our institution's unwavering efforts to align with sustainability principles, emphasizing the critical role of awareness, knowledge, and collective responsibility in driving meaningful change.

The Green/Energy/Environmental Audit Report 2023-24 is the result of the meticulous efforts of our audit committees, which comprises of researchers/sustainability experts, and campus managers. Through their diligent assessments, this report provides a holistic view of our ecological footprint, evaluating our energy efficiency, waste management, water usage, and overall environmental impact. The report highlight our strengths while identifying opportunities for improvement, enabling us to take informed and impactful steps forward.

As we present this report to our stakeholders, it is with a renewed sense of optimism and determination. We recognize that the choices we make today are vital for securing a sustainable future for the generations to come. The findings outlined in this report challenge us to rethink traditional practices, adopt innovative solutions, and integrate eco-consciousness into every facet of our institution's operations.

I extend my heartfelt gratitude to every individual who has contributed to this audit report. Your dedication to advancing sustainability reflects the collaborative spirit and shared purpose that define our institution.

May this report serve as a compass, guiding us toward more sustainable practices, fostering a culture of environmental awareness, and inspiring collective action. Let us seize this opportunity to champion sustainability, confident that every step we take today will reverberate positively in the years to come.

Together, we embark on this journey toward a greener, cleaner, and more sustainable future, driven by the profound understanding that nurturing our environment is integral to nurturing ourselves.

With gratitude and determination,

(Prof. Ganga Prasad Prasain)

राष्ट्रीय प्रौद्योगिकी संस्थान सिलचर
National Institute of Technology Silchar
(राष्ट्रीय महत्व का संस्थान)
(An Institute of National Importance)
असम / Assam-788010

फोन/Phone : (03842) 224879 वैब/Web : http://www.nits.ac.in E-mail : director@nits.ac.in
फेक्स/Fax : (03842) 224797 ई पी ए बी एक्स/EPABX : 233841-5100/5101

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TO WHOMSOEVER IT MAY CONCERN

This is to certify that the Green Audit Report 2023-24 of Tripura University is an original internal audit work conducted by the Green Audit Committee to monitor the environmental management practices adopted in the University which is in line with the terms of the International Standards of Internal Auditing.

After going through the report, it is obvious that adequate and appropriate audit procedures were followed for Water Audit, Waste Disposal Audit, and Biodiversity Audit, and the gathered evidences support the conclusions reached and contained in this report.

The suggestions and recommendations prescribed and the conclusions derived are quite genuine and within the achievable limits, and I understand that Tripura University is competent to fulfill those to meet the Sustainable Development Goals.

I recommend and firmly believe that this report meets the requirements prescribed for the development of a Green Campus.

22/1/25

Prof. Nalin B. Dev Choudhury
Dean (Research & Consultancy)
Professor, Electrical Engineering Department
NIT Silchar, Assam 788010

Acknowledgement

The Green Audit Report 2023-24 is the result of the collective efforts of numerous individuals and organizations dedicated to environmental sustainability at Tripura University. We express our heartfelt gratitude to Prof. Ganga Prasad Prasain, Hon'ble Vice Chancellor of Tripura University, for his visionary guidance, constant encouragement, and administrative support throughout this endeavor. His leadership has been instrumental in shaping the environmental stewardship of our university.

We extend our sincere appreciation to the Teaching and Non-Teaching staff, Deans, and Heads of Departments, whose cooperation and assistance were invaluable in aggregating the data necessary for this report. Their active participation reflects the University's collective commitment to environmental preservation.

Special thanks are due to the Tripura Pollution Control Board for their technical support, particularly in the assessment of water quality, and to the Botany and Zoology Department for their expertise in documenting floral and faunal diversity, respectively. We are deeply grateful to Er. Krishna Das, Executive Engineer, and his team for providing vital campus data.

We also wish to express our profound gratitude to Prof. Nalin Behari Dev Choudhury from the Department of Electrical Engineering at NIT Silchar, who served as the External Expert for this audit. His expertise greatly enhanced the depth and quality of our findings.

Special acknowledgment is reserved for Dr. Thiru Selvan, the Convener of the Green Audit Committee 2023-24, for his tireless efforts and unwavering dedication to compiling this comprehensive report. His leadership and meticulous coordination were crucial in bringing this initiative to fruition. Thanks are also due to the contribution of Ms. Lumgailu Panmei, Ph. D Scholar, Department of Forestry and Biodiversity in compiling the results of the Questionnaire Survey.

Finally, we thank all the members of the Green Audit Committee, whose hard work and collaboration were the backbone of this report. Their collective efforts have laid the foundation for the continued environmental progress of Tripura University.

It is our hope that this report inspires a shared sense of responsibility among all stakeholders to embrace and implement its recommendations, ensuring a greener and more sustainable future for our campus and beyond.

Prof. Badal K Datta
Chairman

Tripura University Green Audit Committee
2023-2024

Chairman

Prof. B. K. Datta, Dean, Faculty of Science, Tripura University

Members

Dr. S.S. Singh, Dept. of Zoology, Tripura University
Mr. N. Tripura, Electrical Engineer, Tripura University
Mr. Rajesh Banik, Civil Engineer, Tripura University
Mr. Krishna Das, Executive Engineer, Tripura University

External Expert

Prof. Nalin Behari Dev Choudhury, Department of Electrical Engineering, NIT, Silchar.

Convener

Dr. Thiru Selvan, Dept. Forestry and Biodiversity, Tripura University

CONTENT

INTRODUCTION

Tripura University (a central university), established as a State University on October 2nd, 1987, with the enactment of the Tripura University Act in the Tripura Assembly, in deference to the long-cherished aspirations of the people of the state emerged from the renowned Calcutta University starting from the Starting from a modest P.G. Centre of Calcutta University (CUPGC) in 1976. Situated in the North Eastern region of India, the university has been committed to achieving academic excellence by offering quality teaching, learning and cutting-edge research experiences in different disciplines of Arts, Commerce, Humanities, Management, Science and Technology. The campus is nestled in a lush, semi-urban expanse of 75 acres along the National Highway at Suryamaninagar (23°45′40″N; 91°15′58″E), approximately 9 kilometers south of Agartala, the capital city.

Designated as one of the 56 Central Universities in India, Tripura University was founded on July 2nd, 2007, through a parliamentary act with the purpose of establishing a teaching and affiliating institution in the state. With Memorandum of Understandings with several National and International Institutions and numerous patents to its credit, this University, notwithstanding its geographical remoteness and other communicational disadvantages in the past, has always tried to compete with other universities of the country in terms of academic accomplishments, research breakthroughs, innovation and placement records, which have been aptly reflected in its NAAC Assessments and NIRF rankings. Notably, the university has made significant strides, enhancing its infrastructure and academic landscape.

Presently, the university offers diverse programs through its Science, Literature, Social Sciences, Commerce, Law, Management and Information Science Faculty. Its academic portfolio comprises a total of 65 programs, encompassing Undergraduate, Postgraduate, Doctoral, and other Postgraduate Programs. Additionally, the university provides Ph.D. programs in 41 subjects. With an annual enrollment exceeding about 1500 students, the campus serves as a hub of education and exploration. Moreover, Tripura University fosters pioneering research initiatives spanning various fields.

The university boasts 44 well-equipped departments, seven centres and one school, each furnished with state-of-the-art classrooms, laboratories, continuous internet access, a computer center, library, free Wi-Fi campus-wide, sports facilities, an open-air theater, health services, banking amenities, a cafeteria, post office, food court, hostels, and a guest house. Its esteemed faculty is not only dynamic but also compassionate and approachable. Alongside regular academic sessions, the university promotes a variety of sports and socio-cultural activities, including film screenings, musical performances, art festivals, debates, university fairs, sports tournaments, and wellness walks.

Set against a backdrop of scenic beauty, the campus encompasses lakes, woodlands, hills, flower gardens, and fruit orchards, creating a tranquil environment. The abundance of trees, the fragrance of flora, the chorus of birds, fluttering butterflies, and local wildlife collectively provide a refreshing contrast to academic demands, nurturing and rejuvenating the minds of its student community.

Green Audit at Tripura University

The policy adopted by governments worldwide continues to prioritize boosting labor productivity and economic growth through the development of human capital. Enhancing

workers' knowledge and skills significantly impacts a nation's overall well-being, contributing substantially to GDP growth. Reflecting this commitment, governments have increasingly allocated resources to raise the educational standards of their citizens. Tripura University has steadfastly aligned with these objectives, fostering advancements in education during the academic year 2023-24.

Amid rapid advancements in research across various scientific and technological fields, Tripura University has experienced noteworthy growth and progress. However, this expansion has also led to a rise in carbon emissions. In response, the Government of India, under the visionary leadership of Honorable Prime Minister Shri Narendra Modi Ji, has reinforced environmental responsibility through initiatives such as the 'Swachh Bharat Abhiyan' (Clean India Mission). These efforts resonate with the University Grants Commission's 'Green Campus, Clean Campus' directive for higher education institutions. Additionally, the National Assessment and Accreditation Council (NAAC), an autonomous body under the Indian Government's University Grants Commission, has emphasized 'Environmental Consciousness' as a mandatory assessment criterion (Criterion VII) for educational institutions.

In the academic year 2023-24, Tripura University remains committed to sustainable development, with green auditing playing a pivotal role in campus management. This initiative integrates academic efforts with environmental conservation and management, aligning institutional growth with sustainable practices.

Green auditing involves systematically evaluating practices at Tripura University to ensure eco-friendliness and sustainability. As a powerful tool for ecological stewardship, it fosters a culture of sustainability by consistently identifying, quantifying, documenting, reporting, and monitoring environmentally significant elements. This practice safeguards the decadent floral and faunal diversity on and around the campus and promotes stakeholders' awareness of the importance of sustainability for the future.

Tripura University reaffirms its dedication to resource conservation and sustainable academic practices in alignment with India’s climate neutrality goals. The Green Audit Committee oversees sustainability efforts within the institution's research and educational missions.

Goals of the Tripura University Green Audit Policy (2023-24):

- Identifying and documenting strengths and areas for improvement in sustainable administrative, academic, and research operations through gap analysis and proposing actionable enhancements.
- Promoting environmental consciousness across the campus and motivating stakeholders to optimize resource utilisation sustainably.
- Establishing a comprehensive baseline of environmental parameters and addressing potential environmental concerns proactively.

Commitments of the Green Audit Committee (2023-24):

- Identifying current and emerging environmental challenges.
- Monitoring and enhancing environmental management practices.
- Evaluating existing practices with potential environmental impacts.

- Raising awareness among diverse stakeholders within the university.
- Producing a comprehensive Green Audit Report detailing sustainable practices across departments, administrative functions, and support services.

Tripura University remains steadfast in integrating sustainability into its institutional framework, ensuring a balance between academic excellence and environmental responsibility.

METHODOLOGY ADOPTED

The approach adopted for the Green Audit of Tripura University encompasses the following key elements:

Onsite Inspections: The Green Audit Team conducted extensive onsite visits to assess various sustainability aspects across the campus.

Stakeholder Surveys: Surveys and consultations were carried out with diverse stakeholders, including students, faculty, and staff, to collect data on areas such as water consumption, energy usage, and waste management practices.

Water Quality Assessment: Detailed water quality analysis was performed in accordance with established protocols to ensure compliance with environmental standards and sustainable water resource management.

Geographic Information System (GIS): Advanced GIS tools were utilized to develop an updated and detailed campus map for Land Use and Land Cover (LULC) assessment, supporting better land management strategies.

Floral and Faunal Documentation: Comprehensive documentation and estimation of the campus's floral and faunal diversity were conducted using recognized scientific methodologies to preserve and enhance the ecological balance.

This methodology ensures a thorough evaluation of the environmental sustainability aspects within Tripura University's premises. It integrates diverse data collection techniques and analytical procedures to foster a sustainable and eco-friendly academic environment.

AUDIT STAGE

The Audit Stage of Tripura University's green audit initiative commenced with a thorough assessment of the university's green cover, serving as the cornerstone for a comprehensive evaluation of various environmental aspects. This process involved a detailed examination of critical parameters, including land use and land cover (LULC), water availability and consumption patterns, energy usage, waste generation and management protocols, and conservation methodologies.

The dedicated audit team meticulously documented the diverse facilities across Tripura University's expansive campus, carefully assessing their ecological footprints and environmental impacts. To ensure a holistic understanding, structured questionnaires were distributed to faculty, students, and other stakeholders. These questionnaires were strategically designed to gather insights on topics such as resource usage patterns, energy

efficiency, waste disposal habits, and general environmental awareness.

Data acquisition followed a multi-pronged approach, combining on-site inspections with targeted surveys tailored to specific areas such as water usage, waste management, energy consumption, and biodiversity. This robust strategy ensured the collection of nuanced and actionable information, enriching the overall analysis.

The data collection phase culminated in a systematic and meticulous analysis of the gathered information. Each data point was critically evaluated to identify patterns, trends, and significant observations. This rigorous analytical process laid the foundation for the comprehensive Green Audit Report for 2023-24, which encapsulates the university's ecological standing and provides a detailed roadmap for targeted improvements.

The Audit Stage ultimately served as the backbone of Tripura University's green audit efforts, unveiling valuable insights through systematic data collection, stakeholder engagement, and careful analysis. The resulting Green Audit Report highlights the institution's unwavering commitment to sustainability and environmental consciousness, offering actionable pathways towards an improved eco-friendly future.

POST AUDIT STAGE

The conclusion of the Green Audit at Tripura University marks the transition into the critical Post Audit Stage. This phase focuses on transforming the insights gained from the audit into actionable measures, driving the campus toward enhanced sustainability. The Post Audit Stage reflects Tripura University's unwavering commitment to translating green audit findings into meaningful actions, fostering a sustainable coexistence of academic advancement and ecological mindfulness.

The Post Audit Stage serves as a crucial pillar in Tripura University's green audit journey, reflecting its dedication to environmental stewardship. By acting on these recommendations, the university continues to build a legacy of sustainability, innovation, and ecological harmony for future generations.

LAND USE AND LAND COVER

Nestled against a scenic, undulating landscape, the Tripura University campus boasts a serene wetland at its core, gracefully extending toward the southeastern edge. This wetland, nourished by rainwater, remains vibrant throughout the year, supporting a rich ecosystem of aquatic flora and fauna. Scattered trees across the campus create a lively mosaic of biodiversity, while the thoughtful integration of academic departments, residential quarters, and hostels reflects a harmonious balance between infrastructure and nature.

Recent studies reveal that the campus spans an impressive 97 acres, with the main campus covering 75 acres and an additional 22 acres acquired since 2015. Of this, approximately 36.67 acres (37.80%) are dedicated to orchards, wetlands, the Botanical Garden and Forest Park, Jungle area and playgrounds. The map of the university campus and the land use are depicted in Figure 1, 2 and 3. The extended campus is shown in Figure 4. Strategically planned plantations line internal roads, guesthouses, hostels, residential quarters, and green zones. However, challenges have emerged, including the silting of wetlands and the growth of dense grasses and aquatic weeds in certain areas.

Fig 1: The Map of Tripura University campus

Built-up areas occupy approximately 38.74 acres (~39.94% of the total campus), encompassing academic and administrative buildings, hostels, and residential quarters. Due to limited elevated land, new construction projects have gradually encroached upon the wetland, prompting a shift toward vertical expansion with multistoried structures. Roads connecting these facilities cover approximately 2.82 acres, while playgrounds span nearly 6.43 acres.

Fig 2: Hostels and Academic Building 12 near the lake and plantation area

Fig 3: Sports field near students and scholars' hostel

Figure 4: Extended campus adjacent to the main campus

Observations

- A noticeable decline in vegetated areas has accompanied the construction of new buildings.
- Post-rainfall, dense weed growth occurs, necessitating annual cleanup efforts to maintain the campus's aesthetic appeal.
- There is a lack of systematic management of roadside avenue trees and other campus flora.
- Controlled burning practices for quick bush clearance are observed and require immediate cessation.
- The campus lacks a comprehensive drainage network, contributing to water management challenges.

Suggestions and Recommendations

1. **Sustainable Development Practices:** Future construction should prioritize seamless integration with the campus's natural aesthetics and minimize ecological disruption.

2. **Preservation of Green Zones:** Protect and enhance the Botanical Garden, Forest Park, wetland, orchards, and jungle areas as vital carbon sinks and biodiversity hotspots.

3. **Tree Management:** Implement rigorous management programs to ensure the health and longevity of planted trees across the campus.

4. **End Controlled Burning**: Cease all controlled burning practices to promote eco-conscious land maintenance.

5. **Drainage Network:** Develop a comprehensive drainage system to effectively address waterlogging and enhance water management.

WATER AUDIT

Water, the essence of life, remains one of the most vital natural resources supporting the survival of all living beings. Its availability is deeply influenced by climatic conditions and

geographical features. While water is abundant in nature, the accessibility of clean and potable water remains a privilege not universally available. Over time, thoughtful conservation practices have emerged to address this challenge, yet unsustainable consumption and overexploitation of water resources continue to threaten their availability. Groundwater, along with water in lakes, ponds, and streams, faces significant risks of contamination and depletion due to increasing human-induced pressures.

The growing threats to water resources emphasize the critical need for their conservation, protection, and sustainable management. In this context, ensuring the efficient utilisation and preservation of water within the Tripura University campus has become a key priority for the academic year 2023-24. A strategic and holistic approach to water management (See figure 5 and 6) is necessary to prevent further degradation and ensure long-term resource sustainability.

Figure 5: Water storage unit

Figure 6: Iron Removal Filter unit

Water auditing serves as an essential tool for evaluating the quality, availability, and utilisation of water resources. Its scope extends beyond mere assessment to include an analysis of existing facilities, practices, and methodologies aimed at replenishing and efficiently managing water. By systematically examining water usage, the audit seeks to

maintain the integrity of these resources, prevent degradation, and ensure their continued sustainability.

As Tripura University undertakes Water Audit, it reaffirms its commitment to responsible water management. This initiative symbolizes the university's dedication to safeguarding and enhancing its water resources, ensuring their availability for future generations. The Water Audit not only highlights the institution's ecological consciousness but also sets a precedent for sustainable practices that contribute to a greener and more resilient future.

Table 1: Land use categories in Tripura University Campus

Sl. No.	**Land Use Category**	**Area (in approx. Acres)**
1	Botanical Garden and Forest Park	3.75
2	Wetland (Lake area)	10.4
3	Play ground	6.43
4	Orchards	10.94
5	Road	2.82
6	Foot Path	0.21
7	Pump Station	0.20
8	Protection Wall	0.02
9	Drain	0.46
10	Retaining Wall	0.02
11	Culvert	0.02
12	Building Under Construction	2.17
13	Overhead Tank	0.009
14	Car Parking	1.48
15	Garage	0.15
16	Building	29.17
17	Transformer	0.104
18	Generator	0.05
19	Security House	0.012
20	Water Pump	0.04
21	Septic Tank	0.88
22	Jungle Area	5.51
23	Tin Shed	0.06
24	Power Sub Station	0.25
25	Toilet	0.49
26	Garden	0.25
27	Statue	0.001

Water Usage and Management

Water Consumption:

On the dynamic campus of Tripura University, water serves as a critical resource, meeting the daily needs of its diverse community. An impressive 431,000 liters of water are drawn daily to support the requirements of residential quarters, academic departments, and administrative offices (refer to Table 2). This considerable consumption underscores the imperative of efficient and sustainable water management practices.

Table 2: Source and uses of water in the TU campus

	Source of water	
	Parameters	**Information**
1	No of Wells	2
2	No of the motors used	2
3	Horsepower- motor	20 HP x 2
4	Depth of well- Total	76 m x 2
5	Capacity of Tank-Total	150000 L
6	Iron Removal Plant	02x 10000; 02x5000; 02x2500; 01x3500
	Quantity of water used in different sections of the Campus	
	Sections	**Water use (L/day)**
7	Hostel	135000
8	Resident quarter	54000
9	Administrative block	8000
10	Construction work	Self-Arrangement
11	Canteen	4000
12	Urinals and Toilets	80000
13	Departments	63000
14	Gardens	50000
15	Laboratories	20000
16	Drinking	12000
17	Leakage	5000
18	Main purposes of water use in the campus	Drinking and cooking purpose Toilets and wash areas Laboratory use, Gardening, Construction
19	Nos. of water tap excluding households/ residential quarters)	1250 Nos
20	Water cooler and drinking water filtration facility (excluding households/ residential quarters)	68 Nos
21	Nos. of urinal and toilets (excluding households/ residential quarters)	113
22	Nos. of waterless /bio-toilets	Nil
23	Any water wastage/why?	Yes, leakage from pipes and tanks, leaving of taps open at times
24	Water usage for gardening	50000 L
25	Wastewater sources	leakage from pipes and tanks, Overflowing of tanks from residential qtrs., Toilets, laboratories, hostels
26	Use of wastewater	Nil
27	The fate of wastewater from labs	Discharged into soak pit in case of contamination and natural discharge
28	Any wastewater treatment for lab water	No
29	Whether any green chemistry method practiced in Labs	No
30	Rainwater harvesting	Rain water harvesting is maintained by the water body within the premises which also helps in maintaining the ground water level

Reuse and Recycle: Sustainable approach

In alignment with sustainable development goals, Tripura University's residential

stakeholders demonstrate commendable practices by reusing greywater—water generated from household activities—for irrigation purposes. This reused greywater nurtures gardens and cultivates vegetable fields, promoting sustainable food practices within the campus. Additionally, water recycling initiatives, activated under proper oversight, further strengthen the university's commitment to minimising water wastage and conserving resources in adherence to its green policies.

Rainwater Harvesting

The campus boasts a natural marvel in the form of a substantial 10.4 acre lake, locally known as "Lunga land." This water body (Figure 7, 10) serves as the centerpiece for the university's rainwater harvesting system. During the monsoon season, rooftop rainwater is efficiently funneled into the lake via an elaborate network of rainwater outlets and reinforced concrete drains. This system not only replenishes groundwater levels but also ensures a steady year-round supply of water for campus use.

To maintain a consistent water level, a sluice gate (Figure 8) and a semi-permanent structure (Figure 9) have been installed. These measures regulate the lake's capacity, ensuring it remains a reliable source for recharging groundwater. Beyond this, the lake supports fish farming and irrigates orchards growing sweet lemon, banana, guava, and other fruits during the pre-monsoon period. The lake also aids the surrounding local community by providing irrigation support for agricultural fields.



From L to R:
Figure 7: Rainwater collection in lake
Figure 8: Sluice Gate
Figure 9: Water level maintenance

Water Quality

Water Source and Treatment:

Tripura University fulfills its water demands primarily through two underground tube wells. The water extracted is subjected to an extensive purification process in an iron removal plant, which integrates oxidation and mixing chambers to ensure its suitability for consumption. This advanced system transforms untreated water—initially rich in sediments and unsuitable for direct use—into potable water.

Quality Analysis:

Ensuring the highest quality standards, water samples are periodically drawn from various campus sources for thorough analysis. These tests evaluate a range of parameters to confirm water safety and suitability for drinking and other uses. The detailed findings from these assessments are summarized in Table 3, which provides a clear picture of water quality on campus.

Tripura University, through sustainable practices such as rainwater harvesting, greywater reuse, and rigorous water quality assessments, exemplifies its commitment to responsible environmental stewardship in the academic year 2023-24. By integrating innovative water management systems and conservation strategies, the university is setting a benchmark for ecological sustainability while ensuring the health and well-being of its community.

Table 3: Water quality analysis report of the water samples obtained from different sources within TU campus

Type of Sample	Water Source/ point of use/ purifier used	TDS (ppm)	pH Range	Turbidity (NTU)	Calcium (ppm)	Magnesium (ppm)
Raw Water	Tap water	102.0	6.82	50	11.11	1.77
Drinking water	Resin cum RO-UV purifier (Model Kent Mineral RO)	88	6.78	<1	13.49	2.22

Ref.No. EQNX:005: LAB: W:24:05:00024-R ULR-TC1223724000000273F,
EQNX:005: LAB: W: 24:05:00023-R ULR-TC1223724000000272F
Note: As per IS: 15185: 2016 methods, Coliform and *E.coli* was not detected in both type of sample

Assessing Lake Water Quality:

Tripura University remains steadfast in its commitment to ecological preservation, as reflected in its comprehensive evaluation of the lake's water quality. This seasonal assessment highlights the institution's dedication to understanding and safeguarding its natural resources.

To evaluate the lake's water quality, a meticulous comparison was conducted, aligning its physico-chemical parameters with benchmarks set by the Bureau of Indian Standards (BIS), the World Health Organization (WHO) for drinking water, and the pisciculture standards defined by ICAR-RC-NEH. The findings, detailed in Table 4, revealed the following:

Most parameters adhered to established drinking water quality standards. However, Dissolved Oxygen (DO) levels and Calcium hardness exceeded desirable limits, necessitating closer monitoring. For pisciculture, parameters such as free carbon dioxide, DO, Total Hardness (TH), and ammonia surpassed optimal levels, raising concerns over potential fish mortality risks.

Indices of Water Quality:

The analysis revealed key insights into the lake's ecosystem:

- The Water Quality Index (WQI) was determined to be 79.95, placing it within the "good quality" range (50–100).
- The Palmer's Algal Pollution Index recorded a value of 12, signifying moderate pollution primarily caused by sediment accumulation during rainfall.

- These indices underscore the university's dual focus on academic inquiry and ecological stewardship, balancing the need for detailed analysis with actionable insights to preserve its natural assets.

Figure 10: Map showing the Tripura university lake

Observations

A thorough evaluation of water management practices at Tripura University has highlighted areas requiring immediate attention:

- ✓ **Absence of Reusable Water Treatment Facilities:** The lack of a dedicated wastewater treatment facility for residential, academic, and administrative buildings impedes efficient recycling and reuse of water.
- ✓ **Overflowing Overhead Water Tanks:** Frequent instances of tank overflow indicate water wastage and insufficient monitoring mechanisms.
- ✓ **Inadequate Monitoring of Water Consumption:** The absence of systematic water usage records hampers the development of targeted conservation strategies.
- ✓ **Sediment Accumulation in the Lake:** Sediment buildup, exacerbated by rainfall, threatens the lake's water quality and ecological balance.
- ✓ **Uncontrolled Water Discharge:** Untreated water discharged from buildings into the lake poses risks to the ecosystem, contributing to pollution and imbalance.

Suggestions and Recommendations

To address these challenges, Tripura University aims to implement innovative and sustainable water management solutions:

1. Enhancing Rainwater Harvesting Systems: Equip all buildings with advanced rainwater harvesting mechanisms to maximize water reuse and replenishment.

2. Launching Campus-Wide Water Conservation Drives: Promote awareness campaigns and engage stakeholders to adopt water-saving practices, fostering a culture of conservation.

Table 4: Seasonal Water quality of Tripura University Lake

	Parameters	Seasons			Drinking		Fish
		Monsoon Mean ± SE	Winter Mean ± SE	Summer Mean ± SE	BIS	WHO	ICAR
1	Temp ^{0}C	31.45 ± 0.11	19.05 ± 0.45	33.4 ± 0.21	-	-	-
2	EC (mhos/cm)	1.62 ± 0.02	1.42 ± 0.01	1.16 ± 0.02	-	-	-
3	Total suspended solid	20.38 ± 1.07	27.63 ± 1.80	29.25 ± 1.66	75	≤ 30	-
4	Total Dissolved Solids	215.75 ± 1.33	304.12 ± 1.76	319.13 ± 2.43	500	500	-
5	pH	7.58 ± 0.04	7.78 ± 0.06	6.91 ± 0.01	6.5-9.2	6.5-8.5	6.7-9.5
6	Total Alkalinity (mg/l)	148.43 ± 2.50	101.67 ± 2.34	167.57 ± 3.05	200	120	50-300
7	Chloride	56.80 ± 2.37	88.75 ± 2.17	128.98 ± 2.97	250	250	-
8	Free CO_2	5.68 ± 0.41	5.5 ± 0.72	7.7 ± 0.57	-	-	5
9	Total CO_2	112.31 ± 0.55	218.10 ± 2.24	136.30 ± 2.35			
10	Dissolved Oxygen	5.02 ± 0.58	5.22 ± 0.84	5.12 ± 0.54	6.0	4.0-6.0	4
11	BOD	1.63 ± 0.18	1.83 ± 0.41	1.08 ± 0.39	-	20-30	<10
12	Total hardness (mg/l)	162.5 ± 2.5	165.25 ± 1.81	177 ± 1.69	300	500	30-180
13	Ca^{2+}hardness	89.75 ± 2.01	104.5 ± 2.69	116.25 ± 2.51	75	75	75-150
14	Mg^{2+}hardness	72.75 ± 2.41	60.75 ± 2.78	72.5 ± 2.87	30	150	-
15	Ammonia	0.98 ± 0.14	0.91 ± 0.10	1.05 ± 0.22	0.5	1.5	0.1

Note: - BIS: Bureau of Indian Standards, WHO: World Health Organization, Reference: IS 10500: 2012, WHO 2004, ICAR-RC-NEH

3. Implementing Automated Overflow Prevention Systems: Install automated sensors in water tanks to prevent overflow, reduce wastage, and streamline water distribution.

4. Adopting Automated Taps: Introduce sensor-operated taps across campus to regulate water flow and minimize unnecessary usage.

5. Establishing a Sewage Treatment Plant (STP): Develop a robust STP to treat wastewater effectively. Treated water can be reused for toilet flushing, irrigation, and other non-potable applications.

Tripura University's dedication to preserving its natural resources and enhancing sustainability is evident through its meticulous water quality assessments and actionable recommendations. By addressing critical challenges such as sediment accumulation, water wastage, and pollution, the institution reaffirms its commitment to a greener future. These initiatives will not only enrich the campus ecosystem but also set a benchmark for environmental stewardship in higher education.

WASTE DISPOSAL AUDIT

The waste disposal audit at Tripura University highlights the intricate dynamics of waste management on campus, aiming to reduce ecological and health risks associated with improper waste handling. The audit underscores the university's dedication to promoting

sustainable practices and environmental stewardship.

Types of Solid Waste Generated

Biodegradable Waste: Includes organic materials like food waste, canteen disposables, and toilet waste, which can be composted or converted into organic fertilizers.

Non-Biodegradable Waste: Comprises plastics, tins, and glass bottles, furniture waste, flat tires, which require recycling or reuse to minimize environmental harm.

Hazardous Waste: Includes materials like corrosive chemicals, acids, and flammable substances, which pose significant health and environmental risks if not managed properly.

Environmental and Health Implications

Improper waste disposal leads to environmental degradation, such as litter accumulation, soil and water contamination, and the release of harmful greenhouse gases. These practices pose serious risks to public health and contribute to climate change. The audit emphasizes the need for systematic waste management to mitigate these impacts.

Current Waste Management Practices

Waste Collection Process:

- Waste is generated across academic departments, administrative offices, hostels, and residences.
- Small waste bins in each department are emptied by housekeeping staff into larger bins.
- Waste is collected bi-daily by the Agartala Municipal Corporation (AMC) for segregation, landfilling, and composting.

Stakeholder Contributions:

- Hostels and faculty accommodations contribute significantly to waste generation, producing an average of 544 kg of solid waste weekly.
- 40% of academic departments and 50% of residential quarters practice separate disposal systems for dry and wet waste.
- Biodegradable waste segregation is partially implemented in teachers' quarters, guest houses, and 20% of academic departments.

Innovative Practices in Waste Management

Vermicomposting:

- The university established a vermicomposting unit (Figure 11) using *Perionyx excavatus* earthworms.
- Organic waste such as leaves, weeds, and kitchen scraps are converted into nutrient-rich vermicompost in 45 days.
- This vermicompost is used in flower gardens and orchards on campus, promoting sustainable agriculture.

Figure 11: Vermicompost unit

Collaboration with AMC:

- AMC collects 90% of the solid waste (Refer to Figure to 12, 13) generated on campus, ensuring effective disposal through composting and landfilling.

Fig 12: Assorted bins for waste segregation at some locations in the campus

Fig 13: Waste bins and collection centres of AMC in TU campus

Challenges in Waste Management

- **Absence of a Dedicated Waste Treatment Facility:** Lack of centralized systems for treating wastewater from academic buildings, hostels, and residences.
- **Overflowing Water Tanks:** Instances of water wastage due to inadequate monitoring systems.
- **Inadequate Waste Segregation:** Limited implementation of systematic segregation of biodegradable and non-biodegradable waste.
- **Sediment Accumulation in the Lake:** Impacts water quality and ecological balance.

- **Untapped Recycling Potential:** Recycling remains underutilized on campus, despite its potential to reduce waste.

Table 5: Solid waste generated on the campus per week

Stakeholders	Types of solid waste	Average waste generated / Week (Kg)	% of waste
Academic Department	Paper waste	82.5	59.57
	Plastic waste	06.0	4.33
	Organic Waste	48.0	34.66
	E-waste	02.0	1.44
Administrative Office	Paper waste	42.0	70.00
	Plastic waste	02.0	3.33
	Organic Waste	15.0	25.00
	E-waste	01.0	1.67
Residential Quarter/Hostels/ GuestHouse	Paper waste	35.0	11.51
	Plastic waste	17.0	5.59
	Organic Waste	250.0	82.24
	E-waste	02.0	0.66
Canteens	Paper waste	15.0	36.14
	Plastic waste	01.5	3.61
	Organic Waste	25.0	60.24
	E-waste	0.00	0.00
	TOTAL	544.00 Kg /week	

Table 6: Nutrient characteristics of different organic wastes

Parameters	C	BC	AC	MC	KW
pH	7.42	6.75	6.3	7.63	10.0
Electrical conductivity (µMho cm^{-1})	580.66	720.00	570.00	990.00	-
Organic Carbon (%)	17.14	19.52	19.83	20.37	36.8
Total Nitrogen (%)	1.26	1.52	1.82	3.08	3.49
Av. Phosphorus (mg $100g^{-1}$)	147.39	48.97	26.15	163.71	0.89 % (Total P)
Av. Potassium (mg $100g^{-1}$)	1000.00	937.33	1087.00	5962.00	2.18 % (Total K)

*C = Cow dung, BC = Bamboo - cow dung, AC = Acacia - cow dung, MC = Mikania - cowdung, KW = Kitchen waste

Table 7: Plant nutrients in vermicompost (after 45 days) derived from organic wastes of TU Campus

Parameters	C	BC	AC	MC	KW
pH	6.85	7.06	6.9	6.71	7.59
Electrical conductivity (µMho cm^{-1})	594.33	870.00	680.66	1387.00	-
Organic Carbon (%)	11.20	17.90	14.92	17.49	10.48
Total Nitrogen (%)	1.96	2.23	2.16	3.83	1.67
Av. Phosphorus (mg $100g^{-1}$)	275.04	130.96	86.88	300.96	1.09% (Total P)
Av. Potassium (mg $100g^{-1}$)	1175.00	1420.00	1589.00	7321.33	0.85% (Total K)

*C = Cow dung, BC = Bamboo - cow dung, AC = Acacia - cow dung, MC = Mikania - cowdung, KW = Kitchen waste

Recommendations for Improved Waste Management

1. Enhancing Waste Segregation Systems:
Implement separate bins for dry and wet waste across all departments, hostels, and residences.
Provide training sessions for stakeholders on proper segregation practices.

2. Establishing a Sewage Treatment Plant (STP):
Introduce an STP to treat wastewater for reuse in irrigation and toilet flushing.

3. Introducing Automated Waste Management Systems:

Use automated sensors to monitor water tanks and prevent overflow.
Adopt automated taps to reduce water wastage.

4. Promoting Awareness Campaigns:

Organize workshops and drives to educate the university community about sustainable waste management.

5. Activating Recycling Initiatives:

Set up recycling units on campus to repurpose non-biodegradable waste.
Partner with local organizations for effective recycling practices.

Tripura University's waste disposal audit reflects a proactive approach to sustainable practices, fostering environmental stewardship. By integrating innovative solutions like vermicomposting, enhancing stakeholder awareness, and implementing systematic waste segregation, the university paves the way for a greener and more sustainable future. Through these efforts, Tripura University exemplifies its commitment to harmonizing academia with ecological responsibility, creating a legacy of environmental consciousness.

Liquid Waste Management

In the symphony of sustainability, liquid waste management stands as a crucial component of Tripura University's green audit initiatives. As the campus continues to thrive as a hub of scientific discovery, academic pursuits, and residential activity, the management of liquid waste emerges as a key area of focus to preserve ecological harmony.
Sources of Liquid Waste

The diverse origins of liquid waste reflect the multifaceted activities that characterize campus life. Together, these sources form a complex liquid waste system, demanding a responsible and sustainable approach to disposal:

Science Laboratories: Chemical and experimental residues generated during research and academic activities.

Hostels and Residential Quarters: Effluents from daily washing, cooking, and cleaning.

Canteen Operations: Wastewater from food preparation and cleaning processes.

Categories of Liquid Waste

Liquid waste on campus is classified into two main categories, each requiring tailored management strategies:

Sewage Waste: Comprising domestic waste from hostels, residences, and canteen facilities. This waste represents the residues of daily life, necessitating systematic containment and treatment.

Effluents from Laboratories, Washing, and Canteen: Laboratory waste includes chemical residues from experiments. Effluents from residential washing and canteen discharges contribute to the liquid waste matrix.

Current Liquid Waste Management Practices

The university has adopted interim methods to manage liquid waste responsibly while striving for more comprehensive solutions:

Soak Pits for Laboratory Waste: Liquid waste from laboratories is directed into soak pits, which prevent contamination of the soil and water table. This practice reflects an eco-conscious approach to chemical waste disposal.

Drainage Channels for Effluents: Other liquid waste, including washing and canteen effluents, flows through drainage channels to support groundwater recharge. These streams highlight the intersection of academic, residential, and operational activities on campus. This system aids in maintaining water balance on the campus.

Challenges and Opportunities

Despite these efforts, the absence of a dedicated Sewage Treatment Plant (STP) is a significant gap in the campus's liquid waste management infrastructure. Without an STP, untreated sewage and effluents could pose risks to both public health and the environment.

Proposed Measures for 2023-24

The university has identified key areas for improvement and envisions a future built on sustainable liquid waste management:

- **Establishment of a Sewage Treatment Plant (STP):** A state-of-the-art STP will enable the treatment of sewage and effluents, reducing environmental impact. Treated water can be reused for irrigation, flushing systems, and maintaining campus greenery.

- **Chemical Waste Treatment System:** Laboratories require dedicated mechanisms for safe disposal of chemical residues, such as neutralization pits and specialized waste containment systems.

- **Awareness and Training Programs:** Concerted efforts is needed to conduct workshops and training for students and staff to promote awareness about responsible

liquid waste disposal.

- **Regular Monitoring:** Install monitoring systems to track liquid waste quality and disposal efficiency.

- **Environmental Regulations Compliance:** Ensure compliance with pertinent environmental regulations.

Vision for a Greener Future

Tripura University's commitment to sustainable liquid waste management is unwavering. The institution strives to create a comprehensive framework that aligns with global best practices in waste management, ensuring the preservation of natural resources while fostering a healthier campus environment. By embracing innovative solutions, promoting stakeholder involvement, and prioritizing sustainability, the university continues its journey towards harmonizing academic excellence with environmental stewardship. In doing so, it envisions a campus where liquid waste management contributes significantly to ecological balance and a greener, more sustainable future.

Biomedical Waste Management

In the grand narrative of sustainability, biomedical waste management emerges as a critical strand in Tripura University's green audit framework. As the university continues to engage in advanced research activities, particularly those involving animal studies, the conscientious handling of biomedical waste underscores its commitment to eco-conscious and ethical practices.

Sources of Biomedical Waste

Certain faculties within the university engage in research involving animals, albeit on a limited scale. These activities generate a small but significant amount of biomedical waste, which includes:

Research Animal Carcasses: A byproduct of scientific exploration that requires special attention and handling.

Other Biomedical Residues: Minor waste associated with laboratory activities involving biological materials.

Although the volume of waste is minimal, its proper management reflects the university's adherence to ethical research standards.

Storage and Ethical Handling

Tripura University prioritizes ethical stewardship in the management of biomedical waste.

Temporary Storage at -20°C: Animal carcasses are stored in designated freezers (See Figure 14) at -20°C, ensuring safe containment and preventing decomposition. This step demonstrates respect for the research process and aligns with global best practices in biomedical waste management.

Figure 14: Biomedical waste storage

Disposal Practices

When the accumulated biomedical waste reaches a manageable volume, the university ensures its responsible disposal through collaboration with external agencies:

Partnership with Agartala Municipal Corporation (AMC): The university hands over biomedical waste to the AMC, which is equipped to handle such waste following municipal and environmental regulations.

Compliance with Regulatory Standards: The disposal process adheres to established biomedical waste management guidelines, ensuring minimal impact on the environment. This seamless transition highlights the university's proactive engagement with the broader civic ecosystem in managing specialized waste.

Commitment to Ethical Research and Sustainability

While the generation of biomedical waste is limited, Tripura University's approach reflects its dedication to maintaining high ethical and environmental standards. By integrating responsible biomedical waste management into its green audit initiatives, the university:

- Reinforces its commitment to sustainable research practices.
- Ensures the dignity and proper disposal of research byproducts.
- Collaborates effectively with community stakeholders for sustainable outcomes.

In the academic year 2023-24, Tripura University continues to showcase its unwavering commitment to sustainability. The meticulous handling of biomedical waste may seem like a minor detail, but it serves as a testament to the institution's broader ethos—one of ethical research, environmental consciousness, and community collaboration.

As the university charts its path toward academic excellence and environmental stewardship, the careful management of biomedical waste becomes a symbol of its dedication to a sustainable and ethical future.

E-Waste Management

Within the vibrant ecosystem of Tripura University, where technology underpins innovation and learning, the institution remains acutely aware of its responsibility toward e-waste management. The campus harmonizes technological advancement with sustainability,

ensuring that the remnants of progress—electronic waste—are responsibly managed.

Sources of E-Waste

The digital infrastructure of Tripura University, encompassing various academic and administrative domains, generates e-waste from the following sources:

Laboratories: Computer labs, electronic labs, Physics labs, Chemistry labs, and Biotech labs contribute significant electronic waste.

Offices: Academic and administrative offices discard outdated equipment and electronic accessories.

This extensive network of e-waste mirrors the dynamic growth of the university's technological landscape, highlighting the need for effective waste management practices.

Composition of E-Waste

E-waste items (Refer to Figure 15 and 16) which have reached the end of their functional life, form the backbone of the university's e-waste stream which includes:

Outdated and Non-functional Equipment: Computers, laptops, printers, scanners, and projectors.

Accessories and Consumables: Cables, cartridges, and batteries.

Laboratory Instruments: Obsolete equipment and circuitry used in scientific research and experiments.

Strategies for E-Waste Management

Tripura University adopts a systematic approach to e-waste management, grounded in sustainability and responsibility. Key practices include:

Reuse and Refurbishment: Functional but outdated equipment is refurbished and reused within the campus, extending its lifecycle.

Recycling: Items beyond repair are handed over to authorized vendors for recycling. This ensures that valuable components are extracted and reused while minimizing environmental harm.

Responsible Disposal: E-waste unsuitable for reuse or recycling is disposed of through certified channels, adhering to environmental standards and guidelines.

Balancing Innovation and Sustainability

As technology evolves rapidly, Tripura University faces a crucial choice between acquiring new equipment and opting for buy-back programs that promote sustainability. The campus increasingly embraces the buy-back option, trading outdated devices for newer ones while ensuring the ethical disposal of the older equipment.

From L to R:
Figure 15: Spent batteries
Figure 16: Spent cartridges, fragments of damaged laboratory instruments

Commitment to Environmental Responsibility

Tripura University recognizes that its technological footprint extends beyond laboratories and offices. The university's e-waste management practices exemplify its commitment to:

- Reducing the environmental impact of discarded electronics.
- Preserving resources through recycling and reuse.
- Promoting sustainability in all aspects of campus life.

In the rhythm of technological advancement, Tripura University conducts a symphony of responsibility and progress. Through its structured approach to e-waste management, the institution not only addresses the challenges of electronic waste but also contributes to the global call for sustainability. As the academic year 2023-24 unfolds, the university's efforts in e-waste management echo its dedication to harmonizing progress with environmental stewardship.

Hazardous Waste

Hazardous waste management forms an essential component of Tripura University's sustainability journey. Recognizing the risks associated with hazardous materials, the University has implemented measures to ensure their responsible handling, transportation, and disposal, aligning with regulatory frameworks and best practices.

Regulatory Framework: Guiding Principles

Tripura University's hazardous waste management practices are shaped by the Hazardous Waste (Management, Handling, and Transboundary Movement) Rules, 2008, established by the Ministry of Environment, Forest and Climate Change, Government of India. These regulations provide the foundation for responsible waste handling across the University.

Sources and Types of Hazardous Waste

Hazardous waste on campus originates from diverse sources:

Laboratories: Academic and research activities generate chemical residues, solvents, and reactive substances.

Administrative and Residential Areas: Batteries, pesticides, and cleaning agents contribute to hazardous waste streams.

Workshops and Maintenance Units: Materials like paints, adhesives, and preservatives add to the waste matrix.

Challenges in Hazardous Waste Management

Limited Awareness: Despite the university's efforts, not all stakeholders fully grasp the regulations and obligations related to hazardous waste.

Disposal Uncertainty: Surveys by the Green Audit Committee revealed a knowledge gap among stakeholders regarding proper disposal pathways.

Varied and Small Quantities: Many hazardous waste types are generated in minimal amounts, complicating centralized management efforts.

KEY OBSERVATIONS FROM THE GREEN AUDIT

The Green Audit conducted during 2023-24 has shed light on critical areas for improvement:

- ✓ **Biomedical Waste Disposal:** Laboratories require a more streamlined and effective biomedical waste disposal system.
- ✓ **Liquid Hazardous Waste:** A sustainable disposal pathway for liquid hazardous waste is needed to prevent environmental contamination.
- ✓ **Plastic Waste Reduction:** Despite progress, achieving a plastic-free campus requires more collective effort.
- ✓ **Vermicomposting:** Current vermicomposting efforts need enhancement to fully realize their potential.

Recommendations for Improvement

From the observations, the following recommendations are proposed to enhance hazardous waste management:

1. **Enhancing Awareness and Training:** Conduct workshops and training sessions to educate stakeholders about hazardous materials and their disposal regulations.

2. **Improving Disposal Pathways:** Partner with authorized treatment facilities for safe transportation and disposal of liquid and solid hazardous waste. Establish clear guidelines for separating and storing hazardous materials on-site before disposal.

3. **Plastic-Free Campus Initiatives:** Promote biodegradable alternatives to single-use plastics across campus. Increase awareness campaigns to encourage responsible behavior among students and staff.

4. **Strengthening Vermi-Composting:** Allocate resources to scale up vermi-composting initiatives, ensuring sufficient organic waste processing capacity.

5. **Centralized Paper Recycling:** Implement a centralized system for paper recycling to minimize waste and extend paper's lifecycle.

6. **Installing an Incinerator:** Set up an incinerator for proper disposal of specific hazardous materials, such as contaminated lab waste, while adhering to environmental safety standards.

Tripura University envisions a future where hazardous waste management seamlessly integrates with its academic and research ethos. Through sustained efforts in education, collaboration, and infrastructure development, the university aims to create a model of responsible waste stewardship.

In the symphony of sustainability, hazardous waste management emerges as a key movement, harmonizing knowledge with action. Guided by the observations and recommendations of the Green Audit, Tripura University steps confidently into a future where progress and environmental consciousness coexist.

BIODIVERSITY AUDIT

The University's Biodiversity Audit reflects its steadfast commitment to preserving and nurturing the living biota that thrives within its boundaries. Through the collective efforts of faculty members, researchers, and students, Tripura University serves as a custodian of biodiversity, implementing conservation practices that mitigate the impacts of human activities and foster sustainable coexistence.

Foundation of the Biodiversity Audit

The Biodiversity Audit is built on a foundation of rigorous scientific research and comprehensive documentation.

Academic Contributions: Research conducted by the Departments of Botany, Zoology, Forestry and Biodiversity underpins the audit. This dedicated work has resulted in authentic documentation of the interplay between biodiversity and the natural ecosystems that flourish on campus.

Conservation Practices: These scientific findings are complemented by an array of conservation initiatives, creating a holistic approach to sustainability.

Objectives of the Biodiversity Audit

The Biodiversity Audit for 2023-24 focuses on:

- **Mapping Biodiversity:** Cataloging the diverse life forms within the University campus.
- **Ecosystem Monitoring:** Observing ecosystem structures, functions, and biodiversity trends.
- **Promoting Conservation:** Implementing practices to safeguard biodiversity and minimize ecological disruption.

Lake Ecosystem

At the heart of the University's biodiversity lies a tranquil lake (Figure 17, 18), a thriving ecosystem that supports life and enhances the campus environment.

Ecological Importance: The lake serves as a haven for migratory birds and aquatic life, particularly during the rainy season.

Utility and Culture: Beyond its ecological significance, the lake provides irrigation for nearby fields and serves as a venue for cultural events, blending functionality with aesthetics.

Symbol of Sustainability: The lake stands as a testament to the University's efforts to balance development with environmental preservation.

Faunal Diversity

Tripura University's campus is home to a diverse array of fauna, contributing to a rich and balanced ecosystem.

Diverse Species: Birds, mammals, insects, and other creatures coexist, creating a vibrant tapestry of life.

Detailed Documentation: The faunal diversity is meticulously recorded and summarized in Table 8, offering insights into the various species groups observed on campus.

Floral Diversity

The University's flora paints a vivid landscape of greenery and beauty, as revealed by extensive studies led by Forestry and Botany Department.

Variety of Plant Life: From towering trees to delicate flowering plants, the campus boasts a rich botanical diversity.

Comprehensive Records: The floral diversity, as catalouged in Table 9, showcases the contributions of students and scholars in documenting the campus's vegetation.

Legacy of Sustainability

Tripura University's Biodiversity Audit is more than a study; it is a commitment to preserving the harmony of life within its campus. Through meticulous research, conservation practices, and active community involvement, the University ensures that its biodiversity thrives for generations to come.

Educational Impact: The Audit serves as an educational tool, inspiring students and researchers to engage with and protect their environment.

Cultural and Environmental Significance: By integrating biodiversity conservation into its ethos, the university fosters a culture of sustainability and unity with nature.

Through these data, Tripura University continues to uphold its commitment to ecological stewardship, ensuring that its campus remains a sanctuary for biodiversity and a beacon of sustainable progress.

Figure 17: Tranquil ambience of TU Lake

Figure 18: A vibrant lake ecosystem with riparian vegetation and migratory birds

Table 8: Faunal diversity in the TU campus

Butterfly Diversity		
1	Common Mormon	*Papilio polytes*
2	Great Mormon	*Papilio memnon*
3	Common Birdwing	*Troides helena*
4	Chocolate Pansy	*Junonia iphita*
5	Lemon Pansy	*Junonia lemonias*
6	Common Sailor	*Neptis hylas*
7	Common pierrot	*Talicada nyseus*
8	Lemon emigrant	*Catopsilia pomona*
9	Common seargent	*Athyma perius*
10	Common lescar	*Pantoporia hordonia*
11	Jezelbel	*Delias eucharis*
12	Limeblue	*Chilades lajus*
13	Tiny Grass Blue	*Zizula hylax*
Skimmers and Dragonflies		
1	Scarlett Skimmer	*Crcothermis servilia*
2	Fulvous Forest Skimmer	*Neurothemis fulvia*
3	Chalky Percher	*Diplacodes trivialis*
4	Ditch Jewel	*Brachythemis contaminate*
5	Slender Skimmer	*Orthetrum sabina*
6	Common Picture Wing	*Rhyothemis variegata*
Herpetofauna Diversity		
Snakes		
1	Painted Bronzeback Tree Snake	*Dendrelaphis pictus*
2	Chckered Keelback	*Xenochropis piscator*
3	Common Wolf Snake	*Lycodon aulicus*
4	Buff Striped Keelback	*Amphiesma stolatum*
Geckos And Lizards		
1	Oriental Garden Lizard	*Calotes versicolor*
2	Common Sun Skink	*Eutropis multrifasciculata*
3	Keeled Skink	*Eutropis carinata*
4	Flat Tailed House Gecko	*Hemidactylus platyurus*
Toads and Frogs		
1	Asian Common Toad	*Duttaphyrnus melanosticus*
2	Common Tree Frog	*Polypedates teraiensis*
3	Pygmy Toad	*Microhyla berdmorei*
4	Tokay Gecko	*Crytodactylus tripuraensis*
5	Indian Bull Frog	*Rana tigrina*
Fishes		
1	Tilapia	*Tilapia* spp.
2	Grass Carp	*Ctenopharyngodon idella*
3	Kuchia	*Amphipnous cuchia*
4	Lati	*Channa punctatus*
5	Magur	*Clarias batrachus*
6	Mowka	*Amblypharyngodon mola*
7	Mrigal	*Cirrhinus mrigala*
8	Bata	*Labeo bata*

9	Kalibaus	*Labeo calbasu*
10	Gonya	*Labeo gonius*
11	Rui	*Labeo rohita*
12	Puti	*Puntius chola*
13	Boal	*Wallago attu*
14	Katla	*Catla catla*
15	Karfu	*Cyprinus carpio*
Tree Shrews, moles and squirrels		
1	Northern Tree Shrew	*Tupaia belangeri*
2	House Shrew	*Suncus murinus*
3	White Toothed Shrew	*Suncus etruscus*
4	Hairy Belied Squirrel	*Callosciurus pygerythrus*
5	Indian Long Tailed Field Mouse	*Apodemus sylvaticus*
Avifauna		
	Common Name	Scientific Name
1	Lesser Whistling Teal	*Dendrocygna javanica*
2	Asian Openbill Stork	*Anastomus oscitans*
3	Indian Pond Heron	*Ardeola grayii*
4	Little Egret	*Egretta garzetta*
5	Little Cormorant	*Phalocrocorax niger*
6	Black Kite	*Milvus migrans*
7	Common Moorhen	*Gallinula chloropus*
8	Bronze Winged Jacana	*Metopidius indicus*
9	Common Kingfisher	*Alcedo atthis*
10	White-throated Kingfisher	*Halcyon smyrnensis*
11	Common Pigeon	*Columba livia*
12	Green bee-eater	*Merops orientalis*
13	Common Myna	*Acridotheres tristis*
14	Red vented Bulbul	*Pycnonotus cafer*
15	Oriental Magpie Robin	*Copsychus saularis*
16	Black Drongo	*Dicrurus macrocercus*
17	Asian Pied Myna	*Gracupica contra*
18	House Sparrow	*Passer domesticus*
19	Eurasian Tree Sparrow	*Passer montanus*
20	Spotted Dove	*Spilopelia chinensis*
21	Green-billed Malkoha	*Phaenicophaeus tristis*
22	Eastern Jungle Crow	*Corvus levaillantii*
23	Greater Flameback	*Chrysocolaptes guttacristatus*
24	Black-hooded Oriole	*Oriolus xanthornus*
25	Asian Palm Swift	*Cypsiurus balasiensis*
26	Lineated Barbet	*Megalaima lineata*
27	Common Goldenback	*Dinopium javanense*
28	Stork-billed kingfisher	*Pelargopsis capensis*
29	Grey-headed fish eagle	*Haliaeetus ichthyaetus*
30	Rufous-necked laughingthrush	*Pterorhinus ruficollis*
31	Chestnut-tailed starling	*Sturnia malabarica*
32	Purple sunbird	*Cinnyris asiaticus*
33	Rose-ringed parakeet	*Psittacula krameri*
34	Barn owl	*Tyto alba*
35	Spotted owlet	*Athene brama*

36	Oriental White Eye	*Zosterops palpebrosus*
37	Red Wattled Lapwing	*Vanellus indicus*
38	Spotted Dove	*Spilopelia chinensis*

Table 9 Summary of some recorded Flora in Tripura University campus

	Scientific Name	Local name	Family
1	*Acacia auriculiformis* A. Cunn. ex Benth.	Akashmoni	Mimosaceae
2	*Ageratum conyzoides* L.	Durkhi	Asteraceae
3	*Ageratum houstonianum* Mill.	Durkhi	Asteraceae
4	*Ailanthus integrifolia* Lam. ex Steud	White Siris	Simaroubaceae
5	*Albizia lebbeck* (L.) Benth.	Koroi	Mimosaceae
6	*Alstonia scholaris* (L.) R.Br.	Chatim	Apocynaceae
7	*Alternanthera sessilis* (L.) R. Br. ex DC.	Matti Khanduri	Amaranthaceae
8	*Anacardium occidentale* L.	Kaju	Anacardiaceae
9	*Annona reticulata* Sieber ex A.DC.	Ataphal	Annonaceae
10	*Anthocephalus chinensis* Hassk.	Kadam	Rubiaceae
11	*Antidesma ghaesembilla* Gaertn.	Elena /khudi jam	Phyllanthaceae
12	*Aquilaria malaccensis* Roxb.	Agor	Thymelaeaceae
13	*Araucaria columnaris* Hook.	Christmas tree	Araucariaceae
14	*Artocarpus heterophyllus* Lam.	Kathal	Moraceae
15	*Averrhoa carambola* L.	Kamranga	Oxalidaceae
16	*Azadirachta indica* A. Juss.	Neem	Meliaceae
17	*Bauhinia variegate* L.	Raktokanchan	Fabaceae
18	*Bombax insigne* Wall.	Semal	Bombacaceae
19	*Borassus flabellifer* L.	Tal	Arecaceae
20	*Caesalpinia bonduc* (L.) Roxb.	Ghagragota	Caesalpiniaceae
21	*Caesalpinia pulcherrima* (L.) Sw.	Radhacura	Caesalpiniaceae
22	*Callistemon lanceolatus* (Sm.) Sweet	Bottle-brush	Myrtaceae
23	*Careya arborea* Roxb.	Kumvira	Lecythidaceae
24	*Carica papaya* L.	Pepe	Caricaceae
25	*Cassia fistula* L.	Bandor lathi	Mimosaceae
26	*Cassia siamea* Lam.	Cassia	Mimosaceae
27	*Chenopodium album* L.	Betho –shak	Amaranthaceae
28	*Citrus limon* (L.) Osbeck	Lebu	Rutaceae
29	*Citrus maxima* (Burm.) Merr.	Jambura	Rutaceae
30	*Citrus reticulata* Blanco	Komala	Rutaceae
31	*Clausena heptaphylla* (Roxb.) Wight & Arn.	Karanphul	Rutaceae
32	*Cocos nucifera* L.	Narikal	Arecaceae
33	*Dalbergia lanceolaria* L.f.	Koroi	Papilionaceae
34	*Delonix regia* (Bojer) Raf.	Krishna chura	Caesalpinaceae
35	*Dendrophthoe falcata* (L.f.) Ettingsh.	Dhaira ful	Loranthaceae
36	*Dillenia pentagyna* Roxb.	Chalita	Dilleniaceae
37	*Diospyros montana* Roxb.	Gaub	Ebenaceae
38	*Elaeocarpus floribundus* Blume	Jolpai	Elaeocarpaceae
39	*Engelhardia spicata* Lesch. ex Blume	Tokiseleng	Juglandaceae
40	*Eucalyptus citriodora* Hook.	Eucalyptus	Myrtaceae
41	*Eucalyptus globosus* Labill.	Eucalyptus	Myrtaceae

42	*Euphorbia tirucalli* Thunb.	Sitla	Euphorbiaceae
43	*Ficus benghalensis* L.	Bot gach	Moraceae
44	*Ficus hispida* L.f.	Dumur	Moraceae
45	*Ficus religiosa* Forssk.	Ashot	Moraceae
46	*Flacourtia jangomus* (Lour.) Raeusch.	Tipa fol	Salicaceae
47	*Glochidion lanceolarium* (Roxb.) Voigt.	Anguti	Phyllanthaceae
48	*Gmelina arborea* Roxb.	Gamai	Verbenaceae
49	*Hymenodictyon orixense* (Roxb.) Mabb.	Latikarum	Rubiaceae
50	*Mesosphaerum suaveolens* (L.) Kuntze	Tukma Ful	Zingiberaceae
51	*Lagerstroemia speciosa* (L.) Pers.	Jarul	Lythraceae
52	*Lannea coromendalica* (Houtt.) Merr.	Jiola	Anacardiaceae
53	*Lantana camara* L.	Lantana	Verbenaceae
54	*Mallotus phillipensis* H. Karst	Kamela	Euphorbiaceae
55	*Mangifera indica* Linn.	Aam	Anacardiaceae
56	*Melastoma malabathricum* (L.) Smith	Lutki	Melastomataceae
57	*Melia azedarach* Blanco	Bon neem	Meliaceae
58	*Michelia champaca* L.	Champa	Magnoliaceae
59	*Microcos paniculata* L.	Asar	Tiliaceae
60	*Millettia pinnata* (L.) Panigrahi	Karach	Papilionaceae
61	*Mimusops elengi* Bojer	Bokul	Sapotaceae
62	*Moringa oleifera* Lam.	Sajna	Moringaceae
63	*Murraya koenigii* (L.) Spreng.	Curry patta	Rutaceae
64	*Musa paradisiaca* L.	Kola gach	Musaceae
65	*Nyctanthes arbor-tristis* L.	Sheoli	Oleaceae
66	*Oldenlandia corymbosa* Linn.	Khet Papra	Rubiaceae
67	*Parkia roxburghii G.Don*	Wakre	Mimosaceae
68	*Peltophorum pterocarpum* (DC.) Backer ex K.Heyne	Radhachura	Caesalpiniaceae
69	*Phyllanthus emblica* L.	Amla	Euphorbiaceae
70	*Polyalthia longifolia* (Sonn.) Hook.f. & Thomson	Devdaru	Annonaceae
71	*Psidium guajava* L.	Goyam	Myrtaceae
72	*Samanea saman* (Jacq.) Merr.	Rain tree	Mimosaceae
73	*Sapindus mukorossi* Gaertn.	Ritha	Papilionaceae
74	*Schima wallichii* Choisy	Kanak	Theaceae
75	*Sesbania grandiflora* Linn.	Bokful	Papilionaceae
76	*Streblus asper* Lour.	Saruwa	Moraceae
77	*Suregada multiflora* (A.Juss.) Baill.	Narenga	Euphorbiaceae
78	*Swietenia mahagoni* (L.) Jacq.	Mahogony	Meliaceae
79	*Syzygium cumini* (L.) Skeels	Jam	Myrtaceae
80	*Syzygium fruticosum* DC.	Jam	Myrtaceae
81	*Syzygium jambos L. (Alston)*	Golap-jaam	Myrtaceae
82	*Tectona grandis L.f.*	Segun	Lamiaceae
83	*Terminalia bellirica (Gaertn.) Roxb.*	Bahera	Combretaceae
84	*Terminalia arjuna (Roxb. ex DC.) Wight & Arn.*	Arjun	Combretaceae
85	*Toona ciliata M. Roem.*	Rangeen	Meliaceae
86	*Trema orientalis Blume*	Naircha	Ulmaceae
87	*Trewia nudiflora L.*	Pitali	Euphorbiaceae
88	*Ziziphus oenoplia (L.) Mill.*	Ban boroi	Rhamnaceae
89	*Ziziphus mauritiana Lam.*	Boroi	Rhamnaceae

Snag Trees

Nestled within the verdant landscape of Tripura University's campus lies a unique ecological marvel—the world of snag trees. Far from being mere remnants of decay, these lifeless yet vital trees, also known as wildlife trees, play an indispensable role in sustaining biodiversity. Snag trees (See Figure 19), standing, dead or fallen, are ecological treasures that contribute to the structural complexity of ecosystems. These trees foster a thriving microcosm of life. They serve as habitats, shelters, and sources of sustenance for countless species, demonstrating that life and decay are interwoven threads of nature's grand design. A recent survey documented 34 snag trees scattered across the campus. These silent remains of beings harbour an astonishing array of life forms, transforming decay into an enduring legacy of biodiversity. By maintaining these snag trees, Tripura University underscores its commitment to ecological preservation and the delicate balance between life and decay.

Figure 19: A collection of standing, fallen and dead snag trees

Wildlife Habitats: Acrobatic squirrels, enigmatic owlets, cooing doves, vibrant parakeets, and resonant barbets find refuge here.

Rich Ecosystems: Woodpeckers, geckos, lizards, and a plethora of species, including snakes, spiders, scorpions, ants, moths, and beetle caterpillars, coexist within this dynamic habitat.

Tree Diversity and Carbon Management

Tripura University's sprawling campus is home to a diverse array of trees that contribute to carbon accumulation and ecosystem sustainability. A study by the Department of Forestry and Biodiversity delved into the campus's tree diversity potential, revealing its vital role in carbon management.

Key Findings of Biodiversity Audit

- ✓ **Diversity and Biomass**: The study identified 66 tree species, representing 56 genera and 32 families, with 1,301 individuals (40.69 individuals per hectare).

- ✓ **Carbon Storage**: The total biomass was estimated at 377.76 metric tons, translating to 11.82 metric tons per hectare, with a carbon stock of 5.91 metric tons per hectare.

- ✓ **Dominant Species**: *Acacia auriculiformis* emerged as the most significant contributor to biomass, while other species like *Anacardium occidentale*, *Artocarpus heterophyllus*, *Cassia siamea*, *Mangifera indica*, and *Sapindus mukorossi* were recognized for their high carbon sequestration potential.

Implications for Sustainability

Strategic planning for tree planting and conservation efforts are essential to maintain and enhance this green haven:

- ➢ Trees not only mitigate ambient temperatures but also purify the air, creating a verdant sanctum.
- ➢ Thoughtful conservation strategies, from nurturing saplings to preserving old trees, will enhance carbon storage and ecological balance.

Enriching Biodiversity

The vibrant ecosystem of Tripura University's campus is a living testament to biodiversity, where flora and fauna interlace in a harmony. However, certain challenges necessitate recalibration to ensure the preservation of this rich tapestry of life.

Observations

- ✓ **A Thriving Ecosystem**: The campus is a place of greenery, characterized by remarkable floral and faunal diversity.
- ✓ **Challenges of Development**: Trees, critical to this ecosystem, face threats from construction activities, highlighting the tension between progress and conservation.
- ✓ **Invasive Species**: Monsoons, while rejuvenating, foster invasive plants and weeds, disrupting the natural equilibrium.

Recommendations

1. **Comprehensive Management**: Implement a strategy tailored to the campus's ecological dynamics to ensure the coexistence of flora and fauna.
2. **Lake Conservation**: Amplify efforts to protect the serene lake, a sanctuary for aquatic life and migratory birds, ensuring its ecological integrity.
3. **Green Vision**: Develop a long-term landscape plan to preserve and enhance tree diversity, safeguarding the campus's green legacy for future generations.

Tripura University's initiatives in biodiversity conservation, from snag tree preservation to tree diversity studies, showcase its unwavering commitment to ecological sustainability. By addressing challenges and implementing thoughtful strategies, the university ensures its campus remains not only a hub of learning but also a sanctuary, where, nature and knowledge flourish in harmony. Through these efforts, the university sets a benchmark for ecological stewardship, creating a lasting legacy for generations to come.

SUMMARY AND CONCLUSION

The Green Audit process remains a cornerstone of Tripura University's sustainability efforts, also during the year 2023-24, and it continued to play a pivotal role in assessing and enhancing the institution's eco-friendly and sustainable practices. This year's audit was a comprehensive reflection of the university's ongoing commitment to fostering green initiatives and the effective management of environmental resources.

The Green Audit for 2023-24 commenced with a broad evaluation of the campus's vegetative cover, waste management practices, water consumption, and overall ecological health. As in previous audits, the team undertook a thorough exploration of the university's infrastructure, facilities, and natural spaces. This year's audit also placed a particular emphasis on new and evolving areas of concern, including the impact of recent development projects on the campus ecosystem.

The 97-acre campus, inclusive of 75 acres within the main university area and an additional 22-acre expansion in 2015, remains home to a diverse range of natural habitats such as orchards, wetlands, and botanical gardens. The audit team noted both the strengths of this natural environment and the challenges posed by ongoing development activities, such as wetland siltation and a decrease in vegetation due to construction. These findings reinforced the importance of aligning growth with environmental preservation.

Water use continued to be a key focus in the 2023-24 audit, building on the previous year's findings. The university's potable water quality remains in adherence to national standards, but concerns around wastewater treatment persisted. The campus benefits from a natural lake, which aids in rainwater harvesting, but there is significant room for improvement in building-level rainwater collection systems. Recommendations have been made for enhancing rainwater harvesting infrastructure, and improved wastewater management which remains a critical area for future action.

Waste management practices on campus were scrutinized once again, with an impressive 428 kg of solid waste generated weekly. The audit team noted continued progress in the segregation of waste, with strong participation in composting initiatives. However, recommendations were made to improve overall waste disposal systems, particularly in expanding the university's capacity to manage organic waste and increase recycling efforts. Special focus was placed on increasing awareness among the student body and staff for more efficient waste disposal.

The management of hazardous waste, while still minimal in quantity, continued to be a point of focus. The university's procedures for hazardous waste disposal and transportation to approved treatment facilities were assessed, with recommendations to improve handling and reporting protocols, especially in laboratories.

E-waste management, on the other hand, was highlighted as a notable success. The university's efforts in efficient recycling, authorized disposal, and buy-back options for technology upgrades showcased its strong commitment to eco-conscious practices. These systems have set a high standard for future technological and environmental integration.

A prominent aspect of this year's audit was the continued focus on biodiversity, aligning with Tripura University's longstanding dedication to preserving its campus ecosystem. The

ongoing work by faculty, researchers, and students to assess and protect the biota on campus is a hallmark of the university's environmental stewardship. Collection of pictorials of the vibrant biota are spread in the Annexure I. The 97-acre expanse hosts a thriving array of flora and fauna, and the campus lake remains a crucial ecosystem service, supporting local wildlife and contributing to biodiversity.

The Green Audit Report for 2023-24 serves as an essential guiding document for the future of Tripura University's environmental policies and sustainability practices. The comprehensive findings, observations, and recommendations from the audit committee and the stakeholders alike (Appendix 1 and 2) provide a roadmap for future actions, ensuring that the university's growth aligns with its green goals. From improving waste management systems and advancing water conservation to enhancing biodiversity initiatives, this audit plays a vital role in shaping the university's commitment to global sustainability.

As Tripura University continues its journey toward a more sustainable future, the Green Audit Report remains a key tool for driving positive change, setting the stage for an environmentally-conscious academic community.

Pictorial of Floral Diversity

Acacia- wattle

Dipterocarpus sp.

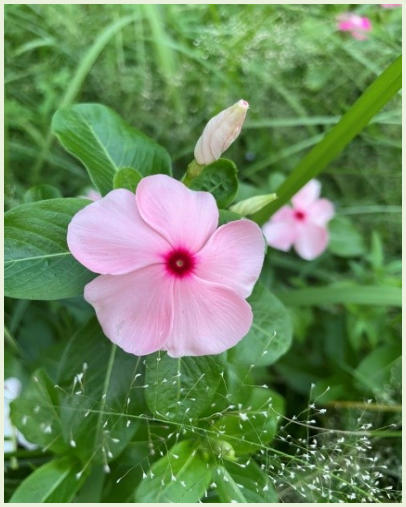
Alstonia sp.

Rubber fig

Melastoma

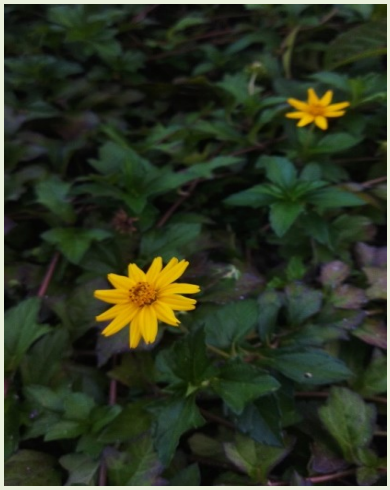
Red periwinkle

Gomphrena

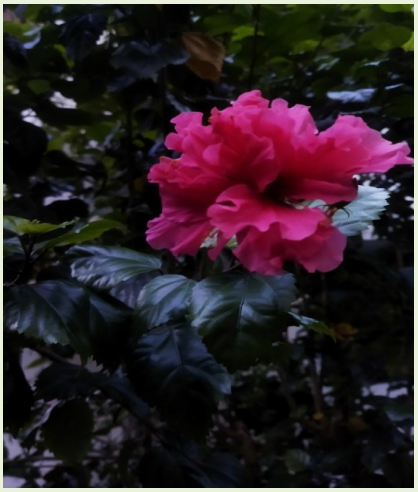


Rosy periwinkle

Copperleaf



Trailing daisy

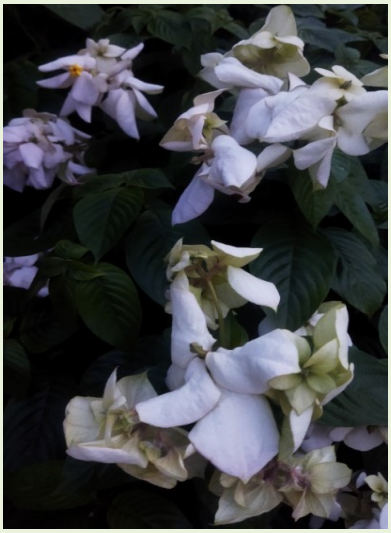


China rose

Groundcherry

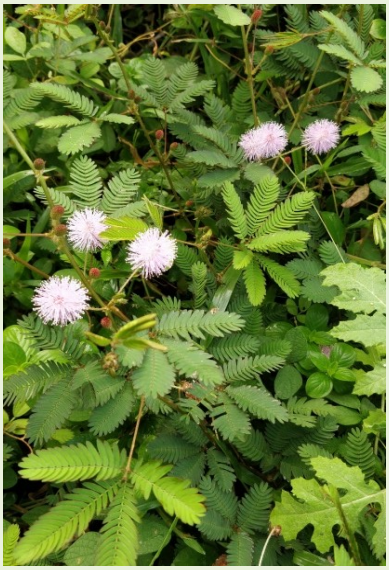
Ixora pink

Ixora red



Mussaenda

Sticky nightshade



Touch-me-not

Sessile joyweed

Pictorial of Insect/ Butterfly Diversity


Pale grass blue

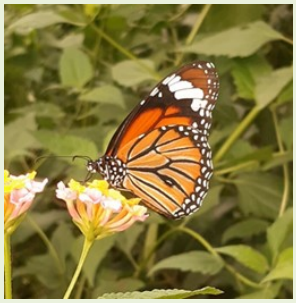

Yellow pansy

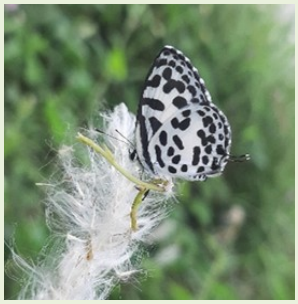

Common five ring


Busck's plume moth


Ciliate blue

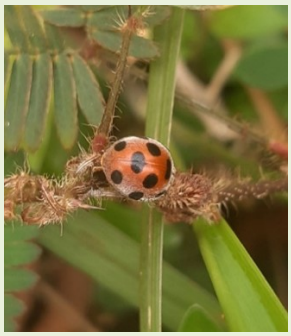

Common mime


Common tiger


Common pierrot


Golden tortoise beetle

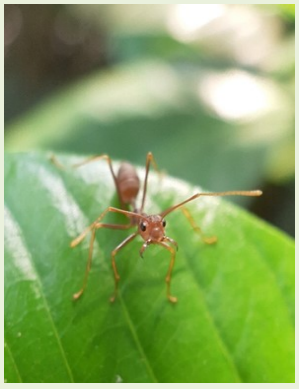

Common milkweed beetle


Squash beetle


Longhorned beetle


Apache wasp


Javanese grasshopper


Asian weaver ant


Oblong winged katydid

Some Glimpses of Biodiversity Rich Green Campus

Pictorial of Green Actions/ Activities

Appendix-I

Green/Energy/Environmental Audit Questionnaire - Tripura University – 2023-2024

Instructions: Please provide accurate and detailed information to aid in the Green/Energy/Environmental Audit Report's data collection and analysis. Your responses are crucial in assessing the university's environmental practices and sustainability efforts.

Section 1: Stakeholder Survey

Please specify if you are a:

Teaching Staff	
Non-Teaching Staff	
Student	
Other (please specify)	

Section 2: General Awareness

a) Whether TU/ any department has conducted awareness/responsibility programme among the staff/student members:

Yes		No		Maybe	

b) Whether all the departments/teachers/non-teaching members/students are aware about the need of the environmental protection and audit:

Yes		No		Maybe	

c) Whether TU has involved the students as volunteers in green activities/ programme:

Yes		No	

d) Whether TU has conducted any workshop/seminar/lecture on environmental awareness programme inside and/or outside the campus:

Yes		No		Maybe	

Section 3: Water Consumption, Usage and Management

a) Whether TU has an efficient and hygiene water storage facility/ structure/ mechanism to minimise the loss of water during storage:

Yes		No	

b) Whether TU has installed/ is using water filter with RO, Aqua Guard and/or large water filter with cooler at strategic locations in the departments/ Central library/ other centres within the campus:

Yes		No	

c) Whether TU has its own mechanism and/ or technical personnel to repair water leakage/ carry out routine inspection:

Yes		No		Don’t know	

d) Whether rainwater harvesting units are installed in TU Campus:

Yes		No		Maybe		Don’t know	

e) Whether TU has developed/ is developing a system for reuse and recycle of water:

Yes		No		Don't know	

f) Whether there is any of necessity for assessing the Water Quality Index (parameters: pH, EC, TDS, Turbidity, metal contaminants- Iron, Arsenic, etc.) of water used in hostel, lab, office, canteen, tap water:

Yes		No		Maybe		Don't know	

g) Whether TU has adequate/ sufficient drainage system:

Yes		No	

h) Do you have any knowledge of the university's water availability and usage patterns?

Yes		No	

i) If your response to the above question is 'Yes' please provide any details you are aware of regarding water usage and conservation efforts: _____

Section 4: Energy Conservation Strategies and practices

a) Whether TU has any provision/choice of renewable and carbon-neutral electricity options:

Yes		No		Maybe	

b) Whether TU is planning / has installed solar panels for harnessing solar energy:

Yes		No		Maybe	

c) Whether TU has efficient water heating system:

Yes		No		Maybe		Don't know	

d) Whether you are concerned in turning off electrical appliances when not in use either in institutional and/ or commercial and/ or residential area:

Yes		No	

e) Whether there is monitoring system to switch off the power mains when not in use:

Yes		No		Don't know	

f) Whether the users follow the appropriate and measurable targets for a reduction of energy, such as, computer, printers, lab equipment when not in use

Yes		No		Maybe		Don't know	

g) Whether there any options for equipment's running on standby mode:

Yes		No		Maybe		Don't know	

h) Whether TU has taken initiative to purchase efficient and environmentally sound appliances in order to fulfill the green budget:

Yes		No		Maybe		Don't know	

i) Whether TU has its own mechanism in repairing of electrical fault:

Yes		No		Maybe		Don't know	

j) Whether the class rooms are with sufficient illumination in day time and ventilation

Yes		No	

k) How many (%) e-notice generated by the college for academic/administrative purposes in a month? _____

l) Whether TU has organized lectures on energy conservation in order to give awareness to the students:

Yes		No		Maybe	

m) How frequently do you use appliances/equipment within the university premises?

Daily		Rarely		Few times a week		Few times a month	

Other: _____

n) Can you provide general characteristics of the appliances/equipment you use regularly? (e.g., lighting, computers, printers, etc.) _____

o) Whether the architectural design for TU is based upon use of natural lighting & ventilation, to save extra power for bulbs and fans:

Yes		No	

p) Whether florescent bulbs are replaced with CFL bulbs/LEDs:

Yes		No		Don't know	

q) Are you aware of any energy conservation strategies or practices implemented within TU?

Yes		No	

r) If your response to the above question is Yes, could you briefly describe these strategies or practices? _____

s) Whether TU has any common car sharing/car pool among the students and faculty:

Yes		No		Maybe		Don't know	

t) Mode of commute to TU:

Public		Private		Walking	

u) If you use private vehicle to commute, please specify the type of vehicle:

4-Wheeler with CNG		4-Wheeler without CNG	

2-Wheeler		Bicycle	

Section 5: Waste Management and Sustainability

a) How familiar are you with the waste disposal practices followed within the university?

Very Familiar		Somewhat Familiar		Not Familiar	

b) Is there any method of segregation of waste materials?

Yes		No		Maybe		Don't know	

c) Have you observed any waste reduction or recycling initiatives on campus?

Yes		No	

d) Whether TU has arranged any workshop/seminar/conference for awareness of the students/staff for specific arrangements for recyclable wastes:

Yes		No		Maybe		Don't know	

e) Whether TU follow specific disposal method for solid or liquid waste in specific manner:

Yes		No		Maybe		Don't know	

f) Whether the recycling/collection facilities are provided by the Agartala Municipality Council and/or private individuals/ organisations (recyclables including glass, white plastic bottle, printer cartridges, cardboard, furniture, plastics, thermocol, waste papers, electrical goods & appliances, electronic gadgets, instruments, equipment, packing materials):

Yes		No		Maybe		Don't know	

g) Whether TU has any composting ground/ waste collection from every household or any collection unit, etc.:

Yes		No		Don't know	

h) Is there any mechanism of treatment/uses of domestic influent in the college campus (if so,

Yes		No		Don't know	

i) If the response to the above question is 'Yes' what is the capacity of treatment plant/composting etc.? _____

j) Are there any incidents of burning of plastics containing garbage within the campus for necessary reduction?

Yes		No		Maybe		Don't know	

k) Whether the cleaning products used by the TU staff are eco-friendly and under the COSHH (Control of Substances Hazard to Health) regulations:

Yes		No		Don't know	

l) Whether TU is using fertilizers, pesticides for any purposes

Yes		No		Don't know	

m) If your response to the above is Yes, please specify amount used per month and places of uses: _____

E-WASTE MANAGEMENT

n) Is there any means of disposal of unused computers, printers and electronic wastes through authorized agents?

Yes		No		Maybe		Don't know	

Section 6: Biodiversity and Land Use

a) Is there any garden inside/outside the campus under TU custody?

Yes		No	

b) Whether the garden is watered by using drip/sprinkler irrigation system:

Yes		No		Maybe		Don't know	

c) Have you come across migratory birds and wild animals in the TU campus?

Yes		No	

d) Have you come across stray animals (dogs, cats) in the TU campus?

Yes		No	

e) Have you noticed any efforts to preserve or enhance biodiversity within the university campus?

Yes		No		Maybe		Don't know	

f) If the response to the above question is Yes, please provide any information about those efforts? _____

g) Is there any mechanism of review or periodical monitoring of tree species?

Yes		No		Don't know	

h) Whether TU has taken any programme for plantation of some fruit trees which can attract birds, bees etc.:

Yes		No		Don't know	

Section 7: Environmental Quality Assessment

a) Have you observed any changes in the ambient environmental quality within the university campus?

Yes		No	

b) If your response to the above question is 'Yes', please describe the changes you've observed: _____

Section 8: Conservation Strategies and Practices

a) Are you aware of any conservation strategies or practices implemented within Tripura University?

Yes		No	

b) If your response to the above question is Yes, please briefly describe these strategies or practices? _____

Thank you for taking the time to complete this questionnaire. Your inputs are invaluable in shaping the Green Audit Report and contributing to Tripura University's commitment to environmental sustainability

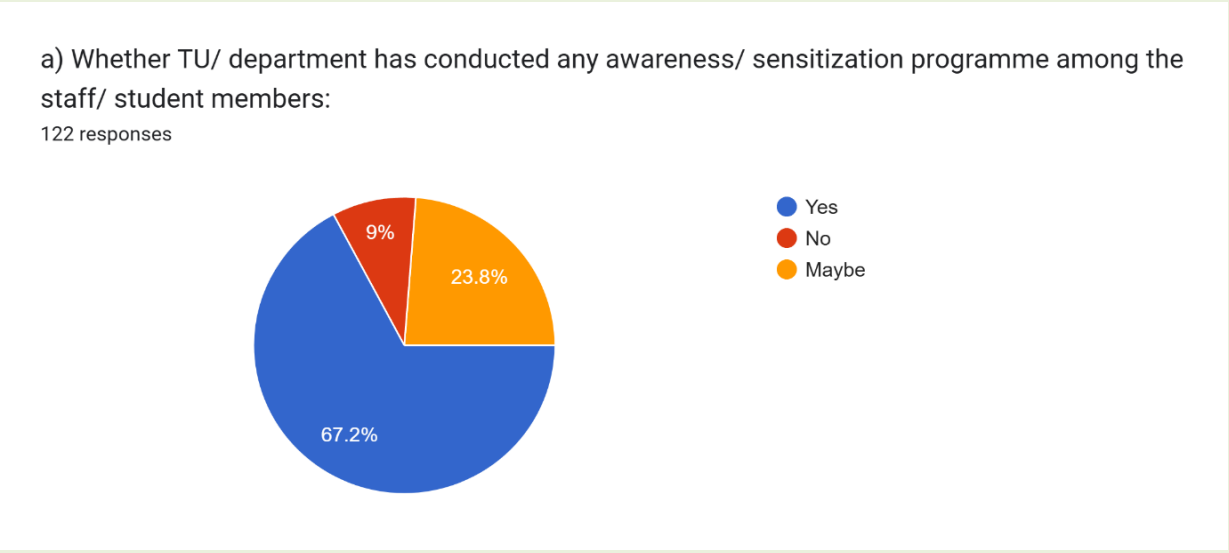
Appendix-II

This section provides brief analysis on the responses being provided by the stakeholders of Tripura University for the Green Audit Report. The university constantly strives to be a model for a green campus that nurtures the intellectual and mental wellbeing of the stakeholders through the protection and conservation of the sanctity and pristine settings. The questions for this report are distributed in various sections of the complete questionnaire set attached as Appendix-I.

The responses have revealed various strengths such as conduction of awareness programme within and outside the campus, maintenance of botanical garden and forest park, use of alternate energy sources, active stakeholder participation in plantation drives, maintenance of floral and faunal diversity, assimilation of organic waste to vermicompost to mention a few. However, there also exist some loopholes which need to be overcome in the upcoming years.

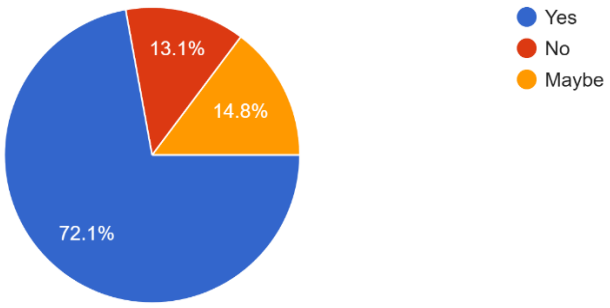
The following charts depicts the scenario of awareness among the stakeholders and the concerted efforts of the department concerned, student participation in green activities, and also sensitization and propagation of green environmental practices. A significant number of the stakeholders are aware of green initiatives while still a large portion are unsure of the mentioned activities. This calls for a greater emphasis on reaching out to each and every stakeholder, motivating them and guiding them to be environmental/ green stewards.

General Awareness



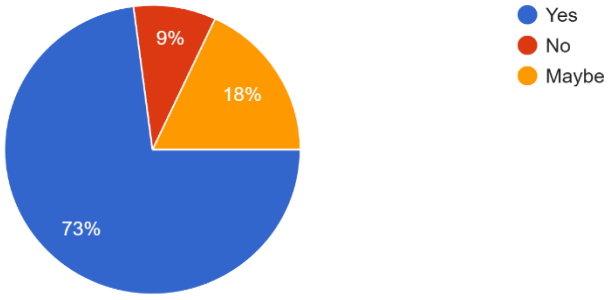
b) Whether all the departments/ teachers/ non-teaching members/ students are aware about the need of the environmental protection and audit:

122 responses



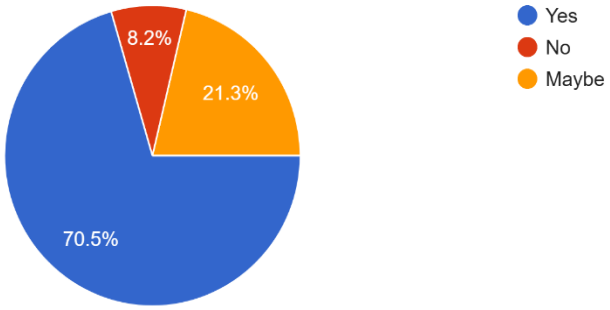
c) Whether TU has involved the students as volunteers in green activities/ programmes:

122 responses



d) Whether TU has conducted any workshop/ seminar/ lecture on environmental awareness programme inside and/or outside the campus for society/ people outside the university:

122 responses

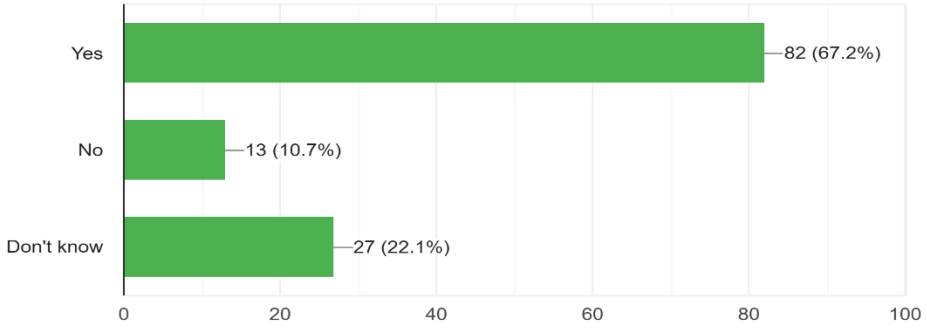


Responsible and judicious consumption and management of resources is a very commendable feature in the Tripura University campus. Some stakeholders have expressed concerns of exclusive dependency on ground water and reiterated the need for rainwater harvesting and storage facility. Meanwhile a stakeholder has also suggested for upgrading the oxidation and filtration facilities to reduce iron content of the water. The stakeholders have observed installed renewable solar energy panels throughout the campus, they also gave their opinions on alternate energy/ green energy sources and also expressed their motivation in saving of energy sources. It is to be noted that the most popular mode of commute is walking thanks to the sufficient housing and hostel facilities in an around the campus. A significant number of students, staffs and faculty members uses public transport for their commute. Only a small proportion of the stakeholders uses private vehicles and a noteworthy point is that CNG fuelled 4-wheeler vehicles, use of bicycle is in comparable number with 2-wheeler and non CNG fuelled 4-wheeler vehicles. The teaching faculty members, students and staff are very responsible in energy use within the campus and their respective residences and public expenses by choosing to opt for energy efficient appliances and voluntarily turning off appliances when not in use. However, a mixed response was seen in self-informed energy reduction efforts. The responses ignite motivation for the university to make greater efforts for residues and waste management and recycling. The university buildings are carefully designed to allow natural light to lit the rooms during daytime for the comfort of the stakeholders in the learning-working space. Some important questions along with responses are given as under:

Water Consumption, Usage and Management

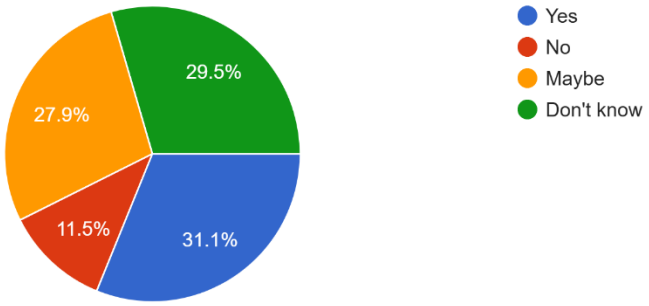
a) Whether TU has an efficient and hygienic water storage facility/ structure/ mechanism to minimize the loss of water during storage:

122 responses



d) Whether rainwater harvesting units are installed in TU Campus:

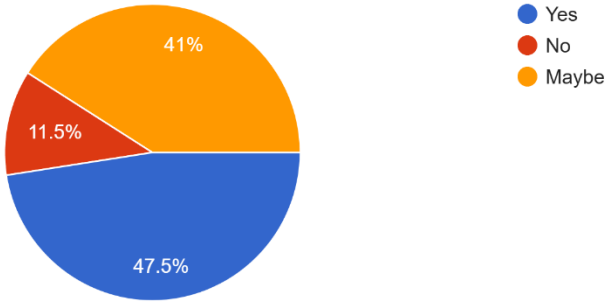
122 responses



Energy Conservation Strategies and Practices

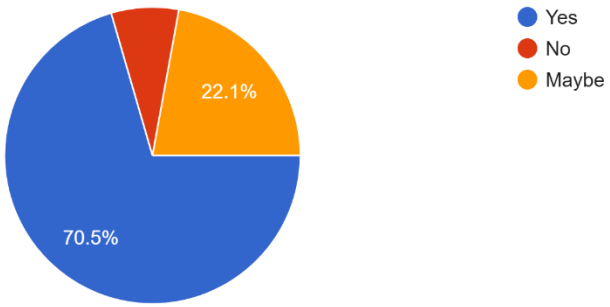
a) Whether TU has any provision/ choice of renewable and carbon-neutral electricity options:

122 responses



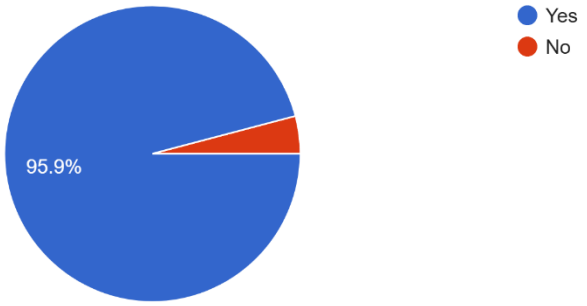
b) Whether TU is planning/ has installed solar panels for harnessing solar energy:

122 responses



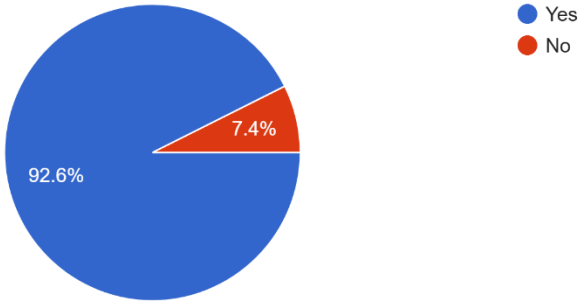
d) Whether you are concerned in turning off electrical appliances when not in use in either institutional and/ or commercial and/ or residential area:

122 responses



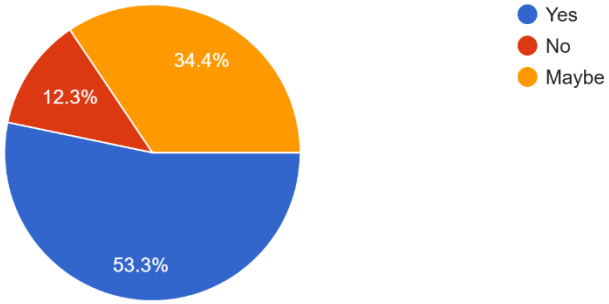
j) Whether the class rooms are with sufficient illumination in day time and ventilation:

122 responses



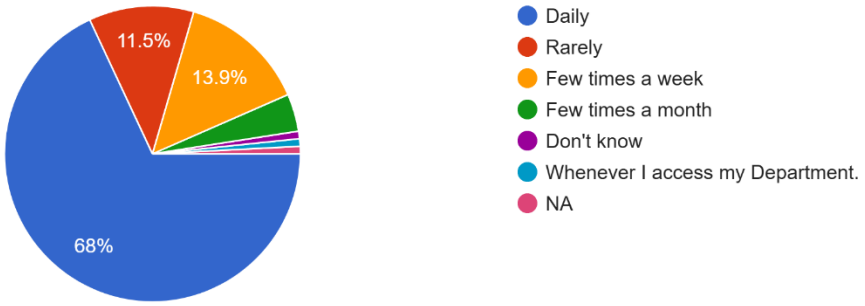
l) Whether TU has organized lectures on energy conservation in order to give awareness to the students:

122 responses



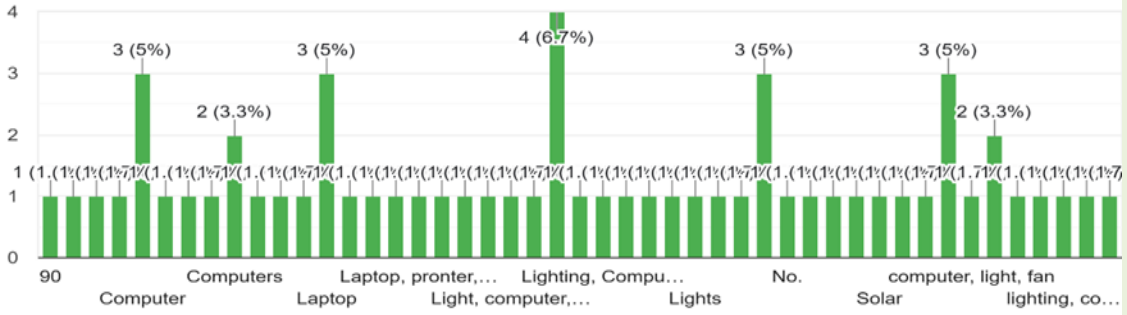
m) How frequently do you use appliances/equipment within the university premises?

122 responses



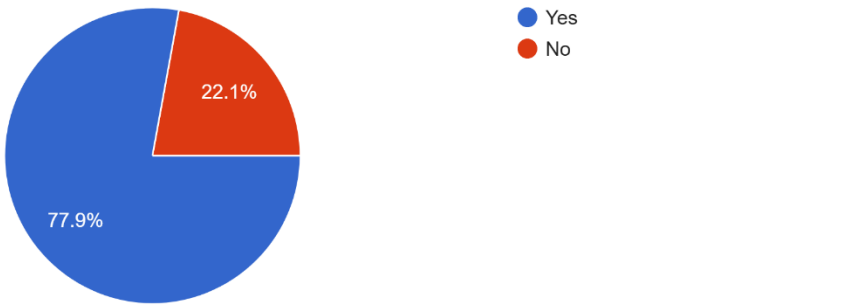
n) Can you provide general characteristics of the appliances/ equipment you use regularly? (eg., lighting, computers, printers, etc.)

60 responses



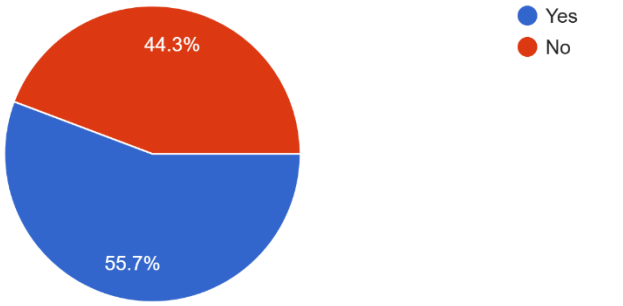
o) Whether the architectural design for TU is based upon use of natural lighting & ventilation, to save extra power for bulbs and fans:

122 responses



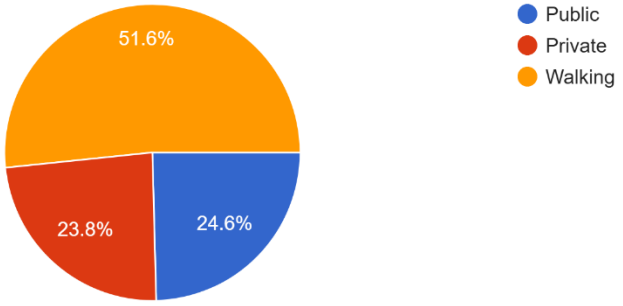
q) Are you aware of any energy conservation strategies or practices implemented within TU?

122 responses



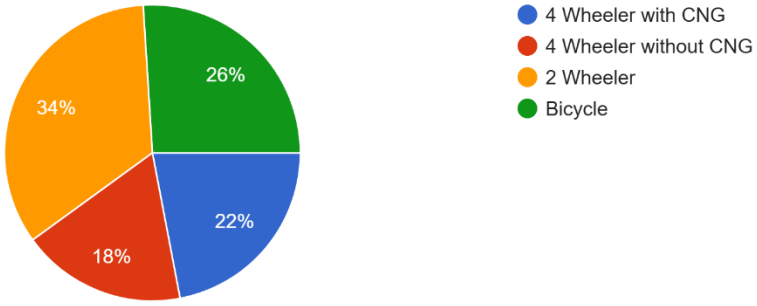
t) Mode of commute to TU:

122 responses



u) If you use private vehicle to commute please specify the type of vehicle:

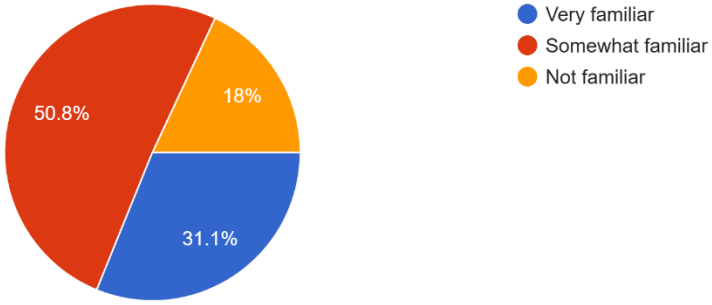
50 responses



Waste Management and Sustainability

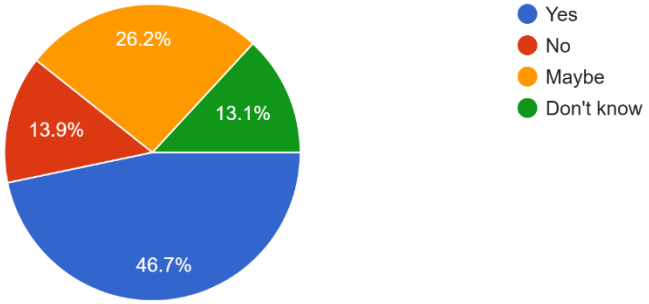
a) How familiar are you with the waste disposal practices followed within TU campus?

122 responses



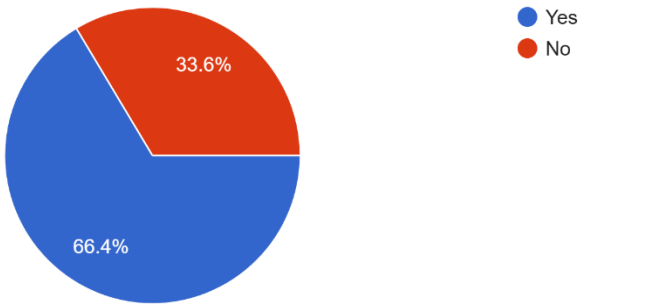
b) Is there any method of segregation of waste materials?

122 responses



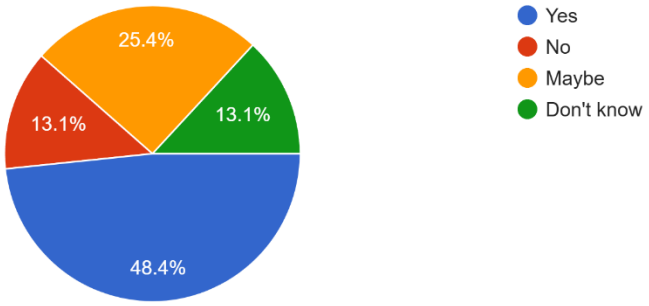
c) Have you observed any waste reduction or recycling initiatives on campus?

122 responses



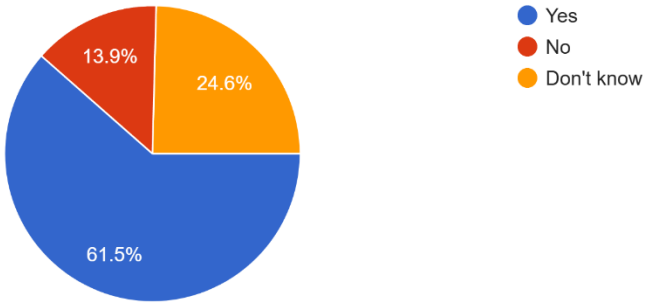
d) Whether TU has arranged any workshop/ seminar/ conference for awareness the students/ staff for specific arrangements for recyclable wastes:

122 responses



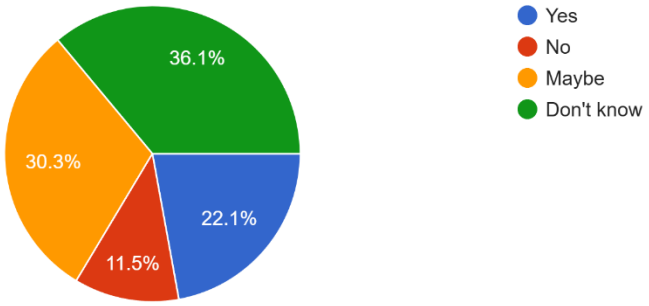
g) Whether TU has any composting ground/ waste collection from every household or any collection unit, etc.:

122 responses



E-waste Management n) Is there any means of disposal of unused computers, printers and electronic wastes through authorized agents?

122 responses

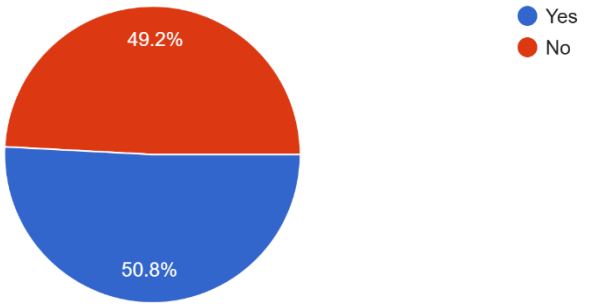


The university has rich biodiversity and also acts as a safe haven for migratory birds in its lake and the forested areas. Some stakeholders have acknowledged the efforts for conservation of biodiversity and shown keenness in participating in green activities. The lush green riparian vegetation around the lake, the bambusetum, the NSS led plantation drives are some exemplary biodiversity conservation efforts witnessed by the stakeholders. The following set of questions has open opinion-based responses which are provided below:

Conservation Strategies and Practices

a) Are you aware of any conservation strategies or practices implemented within TU campus?

122 responses



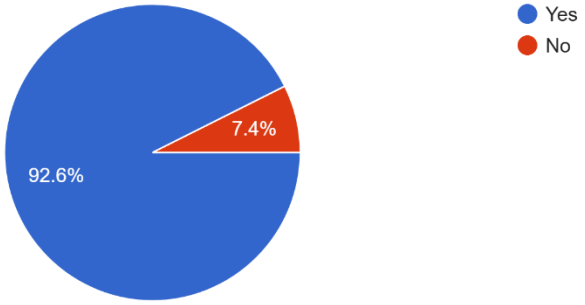
b) If your response is Yes, please briefly describe the strategies or practices:

Plantation drive by the department of Forestry & Biodiversity, Botany & NSS. In this regard Energy Park, which is already present in the campus should be revived and several conservation activities can be implemented.
Solar panel implementation, botanical garden inside campus, vermicompost unit to produce ecofriendly fertilizers.
Rain water harvesting
Vermi compost
Eco club
Planting trees and collection of plastic waste
Yes, we usually collecting plastics from our campus
Bambusetum, botanical garden, Acacia

Biodiversity and Land Use

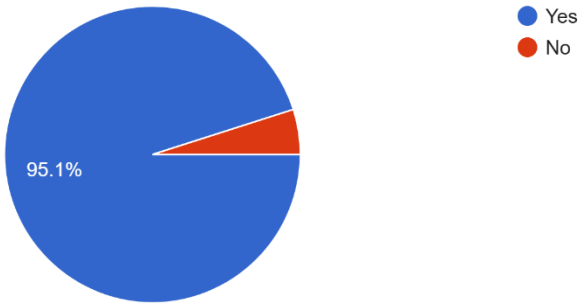
a) Is there garden inside/ outside the campus under TU custody?

122 responses



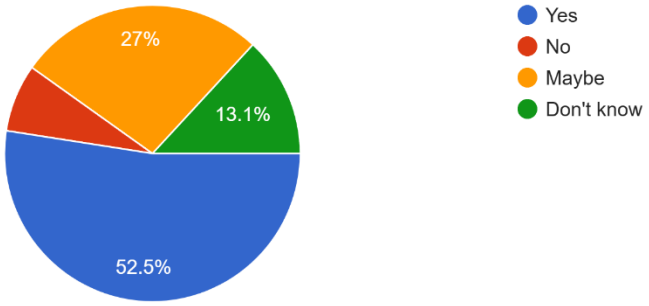
c) Have you come across migratory birds and wild animals in the TU campus?

122 responses



e) Have you noticed any efforts to preserve or enhance biodiversity within the university campus?

122 responses



f) If the response to the above question is Yes, please provide information about those efforts:

They are growing and protecting vegetation
Water point for birds and strays, preventing lake area from being overcrowded in order not to scare away migratory birds
Plantation drive and Botanical Garden is there to preserve biodiversity
They should Maintain the botanical garden; to preserve the ex-situ diversity also they should do beautification to the campus which will help in the development of the surrounding area.
They should also bring some sorts of strategies for the Stray dogs and other animals within the campus.
Botanical Park (energy park), Nursery
Prohibition of hunting within the university
There is regular plantation of fruiting trees and flowers.
The lake provides home to migratory birds during winter and fish throughout the year
Maintaining the pristine nature of the lake to accommodate migratory birds
Our campus has huge lake side where adequate number of migratory birds

TRIPURA UNIVERSITY SURYAMANINGAR TRIPURA (WEST) – 799022

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