



राष्ट्रीय प्रौद्योगिकी संस्थान सिलचर

# National Institute of Technology Silchar

(राष्ट्रीय महत्त्व का संस्थान / An Institute of National Importance)

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Date: 02-02-2023

REF: F.TU/REG/IQAC/AUDIT/06/2023 Dated 01.12.2023

## TO WHOMSOEVER IT MAY CONCERN

This is to certify that the Green Audit Report 2022-23 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 Green 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 requirement prescribed for development of a Green Campus.

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



**Green Audit Report  
(2022-2023)**



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





प्रो. गंगा प्रसाद प्रसाई  
कुलपति

**Prof. Ganga Prasad Prasain**  
Vice-Chancellor

त्रिपुरा विश्वविद्यालय  
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**Tripura University**  
(A Central University)  
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### Forward from Vice Chancellor

In an era defined by the pressing challenges of climate change, resource depletion, and environmental degradation, institutions must transcend traditional paradigms and embrace a holistic commitment to sustainability. This ethos is the cornerstone for Tripura University's relentless pursuit of green, energy, and environmental excellence.

The fourth Green, Energy, and Environmental Audit Report for 2022-23 is a testament to the University's unwavering dedication to harmonizing growth with environmental stewardship. As our planet grapples with the far-reaching consequences of unchecked resource exploitation, the actions of educational institutions become increasingly pivotal in shaping a sustainable future.

This audit report meticulously examines Tripura University's practices through the lens of global environmental imperatives. It delves into the intricacies of energy consumption, environmental management, and green initiatives, presenting a comprehensive analysis that scrutinizes the present and charts a course for a more sustainable tomorrow.

At a time when the world faces escalating climate challenges and biodiversity loss, institutions of higher learning bear a significant responsibility. This report, crafted by the diligent efforts of the Green Audit Committee, is not merely a document; it is a compass guiding the University towards ecologically responsible practices and policies.

The urgency to act cannot be overstated. Through this audit, Tripura University takes a conscientious step forward in mitigating its environmental footprint. The recommendations herein are strategic imperatives for the University and echo the global call for decisive action to preserve our planet's delicate ecological balance.

As we navigate the complexities of the 21st century, let this report manifest our commitment to a sustainable future. May it inspire not only introspection but concerted action. Tripura University's journey towards a green, energy-efficient, and environmentally conscious campus is a beacon of hope, illustrating that positive change is necessary and achievable.

Let this report serve as a clarion call for the academic community, urging us all to become custodians of the Earth and champions of a resilient, sustainable global future.

(Prof. Ganga Prasad Prasain)

## Acknowledgement

Since its inception, Tripura University has consistently taken a leading role and organizing many activities like environmental campaigns, workshops, extension initiatives, etc. aimed at catalyzing societal transformation on both national and global scales. The institution recognizes the imperative of conducting a green audit to ensure the sustainable upkeep and advancement of the University. In its unwavering pursuit of excellence, Tripura University has committed itself to enhancing environmental quality and preserving its pristine ecosystem, thereby securing a promising legacy for forthcoming generations of students and campus inhabitants.

While the University has consistently implemented numerous measures to safeguard and nurture the environment, this 2022-2023 report represents our third formal endeavor to systematically document the outcomes of our investigative work and to provide a comprehensive analysis of all pertinent parameters encompassing the Green audit procedure. Aligned with the climate neutrality goals stipulated by the Government of India, Tripura University aspires to be instrumental in forestalling global ecological catastrophes. To this end, the institution has undertaken a comprehensive approach, including the establishment of a Green Audit Committee comprising faculty members specializing in this domain. This committee is tasked with collecting fundamental environmental data within the campus, thereby facilitating the resolution of environmental challenges *in situ*.

The Green Audit Committee's core objective revolves around the identification of prevailing and emergent environmental concerns. This encompasses a meticulous review of the University's environmental management practices and their subsequent impact on the campus environment. The resulting report is a collective endeavor, driven by each dedicated member of the Tripura University Green Audit Committee and its stakeholders. Through an exhaustive examination of water, waste, and biodiversity parameters, coupled with diligent data compilation and analysis, the committee has pinpointed immediate and pressing threats within the campus environment. By formulating pertinent recommendations and suggestions, this report seeks to lay the groundwork for continuous enhancement of our environmental benchmarks and performance.

The report underscores the significance of garnering the attention and engagement of all stakeholders. By championing a bottom-up approach, we endeavor to collectively confront the challenges that lie ahead. In this collaborative pursuit, the report emerges as a pivotal resource to guide meaningful action and to foster an enduring culture of environmental responsibility.

We extend our sincere appreciation for the valuable encouragement and administrative backing provided by Prof. Ganga Prasad Prasain, Hon'ble Vice Chancellor of Tripura University, throughout the course of this study. His guidance has served as a beacon, and on behalf of the Green Audit Committee-2022-2023, I express profound gratitude to him for his benevolent support. Our gratitude is also extended to the all Teaching, Non-teaching staff, Deans and Heads of Departments of Tripura University for their generous assistance in aggregating data for this report.

Special recognition is owed to the Member Secretary of the Tripura Pollution Control Board, whose assistance was instrumental in conducting the assessment of water quality; the Botany Department, which contributed insights into Floral Diversity; Prof. Priyashankar Chaudhuri (Retd.), whose initiative in Bio-waste management was invaluable and Er. Krishna Das, Executive Engineer, along with his team, for providing essential campus data.

We extend our sincere appreciation to Prof. Nalin Behari Dev Choudhury from the Department of Electrical Engineering at NIT, Silchar, for his invaluable role as the External Expert for the Green Audit 2022-23. His expertise and insights greatly enriched the audit process. Prof. Mishra's dedication to this endeavor significantly contributed to the depth and quality of our findings.

A heartfelt acknowledgment is reserved for all committee members who played an integral role in the creation of this report. In particular, I extend special thanks to Dr. Thiru Selvan, the convener of the Tripura University Green Audit Committee -2022-23, for his unwavering commitment to compiling this report.

It is my sincere belief that the collective efforts of the current Green Audit Committee will greatly benefit Tripura University. I earnestly hope that embracing the management plan outlined in this report becomes a shared responsibility among all stakeholders of the university, as we strive to diminish our environmental footprint.

Prof. Badal K Datta  
Chairman

**Tripura University Green Audit Committee  
2022-2023**

**Chairman**

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

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Prof. R.K. Nath, HoD, Dept. of Chemistry, Tripura University

Prof. Y.V. Krishnaiah, Dept. of Geography & D.M., Tripura University

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## Introduction

Tripura University, established as a State University on October 2nd, 1987, emerged from the renowned Calcutta University. Situated in the North Eastern region of India, the university has been committed to achieving academic excellence. 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, it originated from the former CUPGC.

Designated as one of the 49 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. Notably, the university has made significant strides, enhancing both its infrastructure and academic landscape.

Presently, the university offers a diverse array of programs through its Science, Arts, and Commerce Faculty. Its academic portfolio comprises a total of 57 programs, encompassing Undergraduate, Postgraduate Diploma, and other Postgraduate Programs. Additionally, the university provides Ph.D. programs in 38 subjects. With an annual enrollment exceeding 4000 students, the campus serves as a hub of education and exploration. Moreover, Tripura University fosters pioneering research initiatives spanning various fields of arts, commerce, science and technology.

Despite its geographical remoteness and communication challenges, the university remains dedicated to competing nationally in academic accomplishments, research breakthroughs, innovation, and successful placements. This commitment is aptly reflected in its commendable NAAC Assessments and NIRF rankings.

The university boasts 46 well-equipped departments, 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 embraced by governments' worldwide aims to bolster labor productivity and economic growth through the accumulation of human capital. Workforce development can be significantly influenced by enhancing the knowledge and skills of workers, which in turn has a substantial impact on a nation's future well-being, contributing significantly to GDP growth. This impetus has led governments to allocate substantial resources to elevate the educational standards of their citizens. Tripura University has diligently aligned with these objectives, fostering advancements in education.

Amid the escalating frontiers of research across various scientific and technological domains, Tripura University has witnessed growth and progression. However, this expansion has also contributed to an increase in carbon emissions. The Government of India, under the leadership of Honorable Prime Minister Shri Narendra Modi Ji, has pursued a congruent direction by launching the 'Swachh Bharat Abhiyan' (Clean India Mission), echoing the message of the University Grants Commission's 'Green Campus, Clean Campus' initiative for higher educational institutions. The National Assessment and Accreditation Council (NAAC), an autonomous body funded by the Indian Government's University Grants Commission, has made 'Environmental Consciousness' a mandatory criterion (Criterion VII)

for grading educational institutions.

Presently, Tripura's focal point rests on sustainable development, wherein green auditing assumes a pivotal role in campus management. This entails integrating academic endeavours within the realms of environmental conservation and management.

Green auditing involves the systematic evaluation of practices adopted at Tripura University to ascertain their eco-friendliness and sustainability. Serving as a potent ecological instrument, it cultivates a culture of sustainability through consistent identification, quantification, documentation, reporting, and monitoring of environmentally significant elements. Green auditing endeavours to safeguard the diverse floral and faunal ecosystem within and around the campus. Moreover, it stimulates interest and awareness among stakeholders for the future.

Committed to judicious resource management and pioneering sustainable academic practices, Tripura University aligns with India's climate neutrality goals. The institution is dedicated to monitoring the sustainability of its research and educational missions through the Green Audit Committee.

The goals of the Tripura University Green Audit policy encompass:

- ❖ Identifying and documenting strengths and areas for improvement in sustainable administrative, academic, and research operations through gap analysis, proposing actionable steps for further enhancements.
- ❖ Elevating environmental consciousness across the campus, motivating stakeholders to optimize the sustainable utilization of available resources.
- ❖ Establishing a comprehensive baseline of environmental parameters and proactively resolving potential environmental concerns.

To accomplish the aforementioned objectives, the Tripura University Green Audit Committee is committed to:

- ❖ Identifying existing and emerging environmental challenges.
- ❖ Monitoring environmental management practices.
- ❖ Evaluating prevalent practices with potential environmental impact.
- ❖ Raising awareness among diverse university stakeholders.
- ❖ Producing a Green Audit Report outlining sustainable practices across departments, support services, and administration.

## METHODOLOGY ADOPTED

The approach taken to perform the Green Audit of Tripura University encompasses the subsequent elements:

**Onsite Inspections:** The Green Audit Team conducted onsite visits as deemed essential.

**Stakeholder Surveys:** Inquiries were carried out among diverse stakeholders to gather insights into aspects such as water consumption and waste management.

**Water Quality Assessment:** Rigorous water quality analysis was executed following established protocols.

**Geographic Information System (GIS):** GIS tools were harnessed to create a comprehensive campus map for Land Use and Land Cover (LULC) evaluation.

**Floral and Faunal Documentation:** Comprehensive documentation and estimation of floral and faunal diversity were undertaken, adhering to recognized protocols.

This methodology ensures a comprehensive evaluation of the environmental sustainability aspects within Tripura University's premises, encompassing a wide array of data collection techniques and analytical procedures.

**AUDIT STAGE**

The Audit Stage of Tripura University's green audit initiative commenced with a comprehensive assessment of its green cover, serving as a foundational step for an in-depth evaluation of various environmentally relevant aspects. This process encompassed a meticulous examination of critical parameters, including land use and land cover (LULC), water availability and consumption, waste generation and management protocols, and conservation methodologies, among others.

The audit team, comprising dedicated members, meticulously documented the diverse facilities situated across the expansive Tripura University campus, meticulously gauging their ecological footprints and influences. In pursuit of a comprehensive understanding, structured questionnaires were administered to the university's staff, students, and other stakeholders. These questionnaires were skillfully designed to extract detailed insights into appliance usage patterns, frequency, and general characteristics, thereby adding depth to the data collation process.

Data acquisition was multi-pronged, involving both on-site visits and targeted questionnaires that were tailored for specific sectors such as water, waste, and biodiversity. This approach ensured the collection of nuanced information, enriching the overall analysis.

The culmination of this rigorous data collection phase was the meticulous collation and systematic analysis of the gathered information. Every piece of data was scrutinized, allowing patterns, trends, and significant observations to emerge. This analytical process laid the groundwork for the comprehensive green audit report of Tripura University, effectively capturing the institution's ecological standing and offering a roadmap for targeted improvements.

In essence, the Audit Stage served as the backbone of Tripura University's green audit endeavor, unveiling a wealth of information through systematic data collection, stakeholder engagement, and meticulous analysis. The resulting audit report stands as a testament to the institution's commitment to environmental consciousness and underscores the path towards a more sustainable future.

**POST AUDIT STAGE****Fostering Sustainable Evolution**

The culmination of the Green Audit at Tripura University heralds a new phase - the Post Audit Stage. This phase is pivotal, translating audit insights into pragmatic actions that propel the campus toward heightened sustainability. Within the context of land use and land cover practices, the campus's unique topography unfolds a captivating narrative.

The Post Audit Stage embodies Tripura University's commitment to actualizing green audit revelations into a sustainable paradigm shift. By embracing these, the university paves the way toward an enriched coexistence of campus advancement and ecological mindfulness, ensuring an enduring legacy of enlightenment, innovation, and environmental stewardship.

**Land use and land cover****Preserving Ecosystem Diversity and Wetlands**

Set against an undulating backdrop, the heart of Tripura University campus cradles a serene wetland, a shimmering gem that gracefully cascades toward the southeastern boundary. Nourished by rainwater, this aquatic haven flourishes year-round, offering sanctuary to an array of aquatic flora and fauna. The enchanting tableau of scattered trees weaves a vibrant tapestry for a diverse spectrum of life forms. Artful integration of Academic Departments, residential quarters, and hostels within this

landscape reflects a thoughtfully orchestrated urban equilibrium.

Insights from the recent study unveil a campus spanning 97 acres. Within this expanse, the main campus covers 75 acres, augmented by an additional 22 acres since 2015. Orchards, wetlands, Botanical garden and Forest Park, and playgrounds collectively embrace 29.07 acres (29.97%; Fig. 1). Orchestrated plantations adorn internal thoroughfares, enclaves housing guesthouses/hostels, residential quarters, and the Botanical garden and Forest Park. Yet, concerns arise from the silting of the wetland and its embrace by dense grass and aquatic weeds in pockets.

### **Balancing the Constructed and the Ecological**

Approximately 38.74 acres (~39.94% of the total area) stand as built domains, encompassing residential quarters, hostels, academic departments, and administrative hubs. Given the scarcity of elevated land, a trend of encroaching upon the wetland for new constructions has emerged. Recent architectural endeavours gravitate toward multistoried structures, a testament to the university's vertical expansion vision. Interwoven road networks bridge buildings, traversing an estimated 2.82 acres, while expansive playgrounds extend across nearly 6.43 acres.



Fig 1: Hostels and Academic Building 12 near the lake and plantation area



Fig 2: Sports field near students and scholars hostel

## Observations

- ❖ A discernible reduction in vegetated areas is witnessed over time, mirroring the emergence of new structures.
- ❖ Post-rainfall, a recurring dense growth of weeds prompts annual cleanups to uphold the campus's aesthetic charm.
- ❖ The absence of well-orchestrated management is evident among roadside avenue trees and other campus flora.
- ❖ Practices of controlled burning, employed for swift bush clearance, demand immediate cessation.
- ❖ The absence of a comprehensive drainage network is noted.

## Suggestions and Recommendations

- ❖ Forge future construction and developmental paths that seamlessly intertwine with the campus's natural aesthetics.
- ❖ Prioritize the preservation of the Botanical Garden and Forest Park, Wetland (Lake area), Orchards, and Jungle Area as invaluable carbon sinks.
- ❖ Enact vigilant management regimes to nurture the health and vitality of planted trees.
- ❖ Cease the practice of controlled burning entirely, championing eco-conscious land maintenance.
- ❖ Establish a comprehensive drainage network to effectively address water management imperatives.

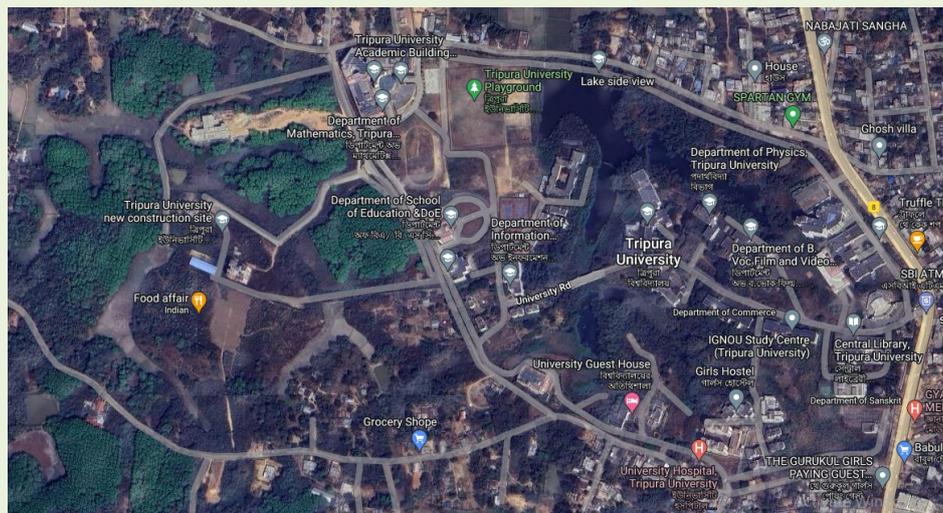


Fig 3: The Map of Tripura University campus

## Water Audit

Water, the lifeblood of our planet, is an indispensable natural resource that sustains all living organisms. Its availability is intricately tied to climatic patterns and geographical features. The significance of water is undeniable, as it serves as the foundation for life itself. However, despite its natural abundance, readily accessible and potable water is a luxury not freely bestowed upon human populations. Through conscientious practices, efforts have been made to conserve and make water available for human consumption. Alas, rampant and unsustainable utilization of water resources has brought forth the twin challenges of contamination and depletion. Groundwater, as well as water held within lakes, ponds, and streams, faces imminent peril due to these anthropogenic pressures.

The escalating threats to water resources underscore the urgency of their conservation, protection, and management. In the face of mounting concerns, the need to ensure the sustainable availability and utilization of water within the campus of Tripura University becomes paramount. A concerted

approach to water management is essential to prevent further deterioration of these vital resources.

Water auditing serves as a comprehensive tool to gauge the quality, availability, and utilization of water resources. Its scope encompasses not only the assessment of these attributes but also an evaluation of the facilities in place and methodologies adopted to rejuvenate and harness water resources. Through systematic assessment, water auditing aims to maintain the integrity of water sources, averting their degradation and ensuring their continued vitality.

As the campus of Tripura University engages in a Water Audit, it reaffirms its commitment to responsible water stewardship. The audit stands as a testament to the university's dedication to protecting and enhancing water resources within its purview. By conducting this audit, the institution takes a crucial step toward safeguarding these invaluable assets, thereby contributing to a sustainable and ecologically conscious 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)              | 7.95                    |
| 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      | 1.03                    |
| 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: A Pragmatic Approach***

#### ***Water Consumption: A Daily Necessity***

Within the confines of Tripura University's vibrant campus, water plays an indispensable role in meeting the daily needs of its occupants. A staggering 431,000 liters of water are drawn from its sources each day, serving the needs of both university residents and the academic and administrative departments alike (Table 2). This consistent and substantial demand underlines the importance of prudent water management.

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

| Source of water  |  |   |
|--|--|---|
| Sl. No   | 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  |
| 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<br>Toilets and wash areas<br>Laboratory use<br>Gardening<br>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 Ltr   |
| 25   | Wastewater sources   | leakage from pipes and tanks,<br>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 and there is no reusable rain water which is harvested |

### *A Sustainable Paradigm: Reuse and Recycle*

In a commendable display of sustainable practices, stakeholders residing within the university's residential quarters embrace the concept of reusing greywater. This greywater, derived from various domestic activities, finds new life in nurturing gardening and cultivating vegetable fields. Additionally, water recycling initiatives operate under the auspices of authoritative guidance, activated as needed. Such initiatives contribute to the holistic goal of preserving water resources and minimizing wastage, thereby aligning with the university's green agenda.

### *Nature's Bounty: The Gift of Rainwater Harvesting*

Tripura University is graced with a natural marvel, a substantial water body nestled within its premises. This sprawling lake not only adds to the campus's aesthetic charm but also serves as a vital reservoir for rainwater harvesting. During the monsoons, the rooftops of the campus buildings channel rainwater directly into the lake through an intricate network of rainwater outlets and reinforced concrete drains. This ingenuity ensures the continuous replenishment of the groundwater table throughout the year, bolstering its levels. To sustain a consistent water level, a sluice gate has been strategically positioned, complemented by a semi-permanent structure. These interventions are pivotal, guaranteeing a stable water level in the lake. Furthermore, this vast water body serves as a natural wellspring for recharging the groundwater and diligently supplying ample water through the university's pumping systems.

As Tripura University embraces sustainable water practices, it not only meets its immediate water needs but also champions the preservation of this precious resource for future generations. Through innovative approaches such as rainwater harvesting and greywater reuse, the institution signifies its commitment to responsible environmental stewardship.

### **Water Conservation facility**

A natural lake extends about 15 acres of land within the premises of the university (locally called Lunga land). This lake recharges the rain water collected from the entire campus and forms the reservoir for fish farming throughout the year. Additionally it also supports agricultural field of the local community along with recharging the ground water table. The lake water also serves the purpose of irrigating the orchards maintained in the campus like sweet lemon, banana, guava, etc. during the pre-monsoon periods.





**Evaluating Water Quality: Ensuring Purity and Potability**

**Water Source and Treatment**

Tripura University meets its water demands through the utilization of two underground tube wells. This water, retrieved via motor-driven mechanisms, undergoes a meticulous purification process within an iron removal plant cum oxidation and mixing chamber. This sophisticated treatment regime renders the water not only consumable but also portable. The transformation is remarkable, as untreated water harbors substantial sediments, rendering it unsuitable for direct use.

**Comprehensive Quality Analysis**

To ensure the adherence of the water to stringent quality standards, a comprehensive assessment of its parameters is imperative. Water samples drawn from various sources within the campus were subjected to thorough analysis. The resultant data, encapsulating quality parameters, findings, and insights, have been succinctly summarized in Table 3. This analytical endeavour provides an accurate representation of the water's quality, thereby ensuring its fitness for consumption and diverse uses.

Tripura University's commitment to ensuring the purity of its water resources is vividly reflected in this stringent quality assessment. By subjecting its water to rigorous scrutiny, the institution safeguards the health and well-being of its occupants while upholding the tenets of responsible environmental management.

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) | Iron (ppm) | Calcium (ppm) | Magnesium (ppm) | COD (ppm) |
|----------------|---|-----------|----------|-----------------|------------|---------------|-----------------|-----------|
| Raw Water      | Tap water   | 50-96     | 6.5-9    | 1.2-5.3         | 0.05-4.5   | 6.2-8.1       | 1.2-1.9         | 55-65     |
| Drinking water | Resin cum RO-UV purifier (Model Kent Mineral RO)    | 25-30     | 6.8-7    | 0.8-1.2         | 0.01-0.2   | 2.9869        | 0.8096          | 35-44     |
| Raw Feed Water | Feed underground water                              | 52        | 6.2-6.5  | 10-22           | 0.4-0.7    | -             | -               | -         |
| Treated Water  | Iron Removal Plant cum oxidation and mixing chamber | 59        | 6.3-6.6  | 0.8-3           | -          | -             | -               | -         |

## *Assessing Tripura University Lake Water Quality*

### *Inquisitive Exploration*

Delving into the ecological intricacies of Tripura University's sprawling lake, a meticulous inquiry into its seasonal water quality was spearheaded by a Master's study from the Department of Forestry and Biodiversity (Prajapati, 2019). The exploration, showcased the institution's commitment to fostering knowledge and understanding of its natural resources.

To gauge the water quality's robustness, an exhaustive comparison was drawn between its physico-chemical attributes and the established benchmarks. These benchmarks were defined by the Bureau of Indian Standards (BIS), the World Health Organization (WHO) for drinking water quality, and the pisciculture standard delineated by ICAR-RC-NEH region. The meticulous comparison, encapsulated within Table 4, yielded insightful revelations.

The observations unveiled a nuanced narrative: nearly all assessed parameters aligned favourably with the standard drinking water quality criteria. However, the concentration of Dissolved Oxygen (DO) and Calcium hardness exceeded desirable limits, warranting vigilant attention. Intriguingly, the parameters pivotal for pisciculture, including free carbon dioxide, DO, Total Hardness (TH), and ammonia, surpassed ideal values. This dichotomy is significant as it hints at a potential risk of heightened fish mortality rates.

### *Indices of Water Quality*

Through systematic analysis, the Water Quality Index for the site was established at 79.95, positioning it within the range of 50 to 100. This placement signifies a positive indication of good water quality. Concurrently, the Palmer's Algal Pollution index unveiled a value of 12, indicating moderate pollution within the lake's ecosystem. According to this index, values between 0-10 signal minimal organic pollution, while 10-15 signifies moderate pollution. The moderate pollution discerned within Tripura University Lake is primarily attributed to sediment accumulation.

As the institution peers into the dynamic realm of water quality, it manifests a deep-rooted dedication to not only academic exploration but also the preservation of its natural assets. By unraveling the complex interplay of parameters and indices, Tripura University demonstrates its commitment to responsible stewardship of its ecological heritage.

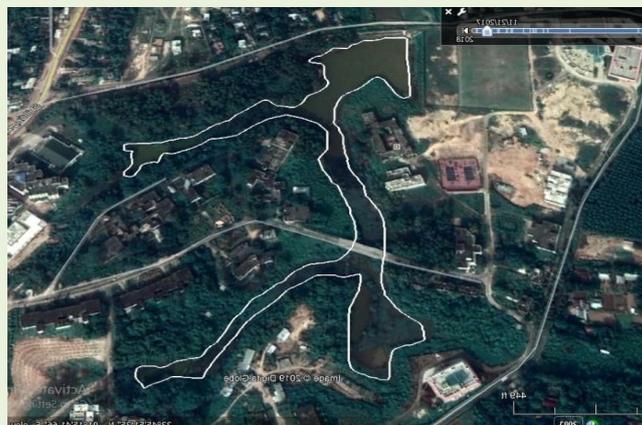


Fig. 4: Map showing the Tripura university lake

### **Observations**

A thorough evaluation of Tripura University's water management practices has unveiled noteworthy observations that demand earnest consideration. Notable observations encompass various dimensions

of water usage, infrastructure, and maintenance, delineating areas that necessitate intervention:

- ❖ **Absence of Reusable Water Treatment Facility:** Notably absent is a dedicated facility for treating wastewater emanating from diverse sources, including academic and administrative buildings, the library, residential quarters, guest houses, hostels, laboratories, and the canteen. The lack of this facility inhibits efficient recycling and reuse of water, amplifying the strain on fresh water resources.
- ❖ **Overflowing Overhead Water Tanks:** Instances of water tanks overflowing have been encountered intermittently. This issue not only signifies wastage but also underscores the need for better monitoring and control mechanisms to ensure optimal utilization.
- ❖ **Inadequate Water Consumption Monitoring:** Effective water resource management is impeded by the absence of systematic consumption monitoring systems across the campus. The lack of accurate records undermines the formulation of targeted conservation strategies.
- ❖ **Sediment Accumulation in the Lake:** The picturesque lake area, while providing an aesthetic charm, grapples with sediment accumulation, particularly during rainfall. This phenomenon jeopardizes both water quality and the ecosystem's equilibrium.
- ❖ **Uncontrolled Water Discharge from Buildings:** Water generated within various buildings is presently discharged into the lake without proper treatment or containment measures, potentially leading to ecological imbalances.

Table 4: Seasonal Water quality of Tripura University Lake

| Sl. No. | Parameters                | Monsoon Mean ± SE | Seasons          |                  | Drinking |         | Fish    |
|---------|---------------------------|-------------------|------------------|------------------|----------|---------|---------|
|         |                           |                   | Winter Mean ± SE | Summer Mean ± SE | BIS      | WHO     | ICAR    |
| 1       | Temp °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 <sub>2</sub>      | 5.68 ± 0.41       | 5.5 ± 0.72       | 7.7 ± 0.57       | -        | -       | 5       |
| 9       | Total CO <sub>2</sub>     | 112.31 ± 0.55     | 218.10 ± 2.24    | 136.30 ± 2.35    |          |         |         |
| 10      | Dissolved Oxygen          | 9.02 ± 0.58       | 9.22 ± 0.84      | 9.12 ± 0.54      | 6.0      | 4.0-6.0 | 4       |
| 11      | BOD                       | 0.63 ± 0.18       | 2.83 ± 0.41      | 4.08 ± 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 <sup>2+</sup> hardness | 89.75 ± 2.01      | 104.5 ± 2.69     | 116.25 ± 2.51    | 75       | 75      | 75-150  |
| 14      | Mg <sup>2+</sup> 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

### Suggestions and Recommendations

In the pursuit of sustainable and responsible water management, Tripura University envisions a future marked by prudent conservation and innovative solutions. With a focus on achieving these goals, the following recommendations are presented:

- ❖ **Enhancing Rainwater Harvesting Systems:** The augmentation of rainwater harvesting systems emerges as a priority. A concerted effort to equip each building with efficient rainwater harvesting mechanisms would foster water reuse and replenishment.
- ❖ **Igniting Water Conservation Drives:** A comprehensive water conservation initiative is advocated, leveraging the participation of all stakeholders. Collective efforts to reduce water consumption through awareness campaigns and conscious practices would yield significant outcomes.
- ❖ **Implementing Automated Overflow Prevention:** The installation of automated sensors to prevent water tank overflow serves a dual purpose: preventing wastage and streamlining water distribution.
- ❖ **Adopting Automated Taps:** The adoption of automated taps aligns with modern technological advancements. By regulating water flow, these taps mitigate unnecessary consumption, contributing to a culture of efficiency.
- ❖ **Establishing a Sewage Treatment Plant (STP):** Introducing a Sewage Treatment Plant on the campus holds substantial potential. This facility could effectively treat wastewater, offering a sustainable source for toilet flushing and irrigation purposes.

Tripura University's journey towards responsible water management rests on the foundation of these insights and recommendations. As the institution moves forward, a commitment to effective conservation practices and prudent resource utilization will pave the way for a greener, more sustainable campus ecosystem.

### Waste disposal audit

The waste disposal audit unravels the intricate web of waste management practices within the university campus, aiming to mitigate the adverse ecological and health implications associated with improper waste handling. The multifaceted nature of waste, encompassing diverse categories, necessitates a holistic approach towards its management.

#### *Assessing Waste Categories*

Solid waste, a byproduct of human activity, is categorized into three distinct classes: biodegradable, non-biodegradable, and hazardous waste. Biodegradable waste encompasses organic materials like food waste and canteen disposables, along with toilet waste. Non-biodegradable waste encompasses commonplace items such as plastic, tins, and glass bottles, often discarded in households and educational institutions. The most critical category, hazardous waste, encompasses materials with potential health or environmental threats, including corrosive chemicals, acids, and flammable substances.

#### *Environmental Implications of Inadequate Waste Management*

The management trajectory of waste is intrinsically linked to the environment and public health. Incorrect storage, collection, and disposal can incite environmental degradation, engendering unsightly litter in communities and precipitating health concerns. The repercussions extend further,

infiltrating soil and water sources with harmful contaminants. Combustion of waste contributes to the release of greenhouse gases, exacerbating global climate change.

### *Catalyzing Sustainable Practices*

A cornerstone of sustainable waste management rests upon the principle of minimization. The audit recognizes the urgency of implementing prudent practices, propelling the following recommendations:

**Hazardous Waste Vigilance:** Special emphasis is placed on the meticulous management of hazardous waste. A proactive stance in handling materials posing potential threats to health and the environment is paramount.

**Biodegradable Waste Valorization:** Transforming biodegradable waste into a resource holds immense potential. Technologies like anaerobic digestion can harness energy from these materials, while composting can yield valuable organic fertilizers.

**Championing Non-Biodegradable Waste Recycling:** The repurposing of non-biodegradable waste through recycling and reuse is pivotal. This approach curtails the environmental burden posed by these materials.

**Scientific Disposal over Unscientific Practices:** The disposal of waste should adhere to scientific guidelines, avoiding practices like pit dumping or burning. Such improper disposal methods can contaminate soil and water resources, perpetuating environmental harm.

### *Holistic Vision for Sustainable Waste Management*

The waste disposal audit functions as a critical lens, appraising existing waste management policies while charting a pathway towards transformation. An imperative fusion of conscientious practices, sustainable technologies, and informed policies is prescribed. Ultimately, the audit serves as a proactive endeavor to mitigate waste-related challenges, safeguarding the environment, and elevating the overall health and sustainability of the university campus.

### **Status of Solid Waste Generation in the campus**

#### *Solid Waste Generation Dynamics*

The intricate web of solid waste generation within the university campus unveils an essential facet of the institution's environmental impact. Every corner of Tripura University, encompassing academic departments and administrative domains, contributes to the generation of waste, necessitating a meticulous evaluation of the prevailing practices.

#### *Microcosmic Waste Handling*

Solid waste generation permeates every department and administrative office, spawning the creation of waste in diverse forms. Small waste bins stationed within departments become repositories for generated waste. Subsequently, the diligent housekeeping personnel orchestrate the transfer of waste from these smaller bins to larger receptacles, effecting a seamless waste management process.

#### *Coordinated Waste Transport*

A cohesive network of waste bins strategically positioned throughout buildings expedites the waste collection process. The vigilant housekeeping staffs diligently congregate the waste from these distributed bins, ensuring a hygienic and organized transition. Ultimately, the collected waste is channeled into larger waste bins, poised for collection by the Agartala Municipal Corporation's waste disposal vehicle.

### *Quantifying the Waste Footprint*

Quantifying the extent of solid waste generation reveals the university's ecological footprint. A comprehensive assessment illustrates the distribution of waste generation across various segments of the campus. Notably, hostels and faculty accommodations, including teacher flats and quarters, emerge as the prominent contributors to the accumulated solid waste.

### *Empirical Insight into Weekly Waste Generation*

As substantiated by empirical data presented in Table 5, the diverse stakeholders of the university collectively generate an average of 428 kg of distinct solid waste variants per week. This robust accumulation underscores the significance of devising sustainable waste management strategies to curtail the ecological implications associated with such significant waste generation.

### *Navigating Toward Sustainable Waste Management*

The assessment of solid waste generation underscores the critical need for holistic waste management strategies within the university campus. With departments, administrative units, hostels, and faculty residences all playing their part in this ecological equation, collaborative efforts are essential to minimize waste generation and optimize its management. The quantification of waste underscores the importance of tailored strategies, which prioritize resource optimization, waste minimization, and sustainable practices. In the collective journey towards an environmentally conscious campus, sustainable waste management takes center stage, fostering a harmonious coexistence between the academic domain and nature.

### **Solid Waste Management**

Within the realm of sustainable practices, the management of solid waste serves as a poignant focal point where all stakeholders converge. It is here that collective awareness finds resonance, and each entity within the university ecosystem orchestrates their individual role in the solid waste management symphony, guided by convenience, requisites, and resource accessibility.

### *Tailored Practices, Unified Objective*

Intriguingly, the multifaceted tapestry of solid waste management weaves together diverse stakeholders, each enacting their own distinctive set of practices. These practices, though unique to each sector, coalesce around the overarching pursuit of sustainable waste management. Departments, administrative units, and other constituents undertake a purposeful approach to waste management, encapsulating a holistic commitment to environmental stewardship.

### *Venturing into Departmental Realms*

Venturing into the labyrinthine corridors of academia, one uncovers a remarkable endeavour. Across the 45 academic departments of the university, a collective of 180 indoor dustbins stand as silent sentinels to the cause of waste disposal. Each department, on average, hosts around five of these vigilant dustbins. However, an intriguing observation emerges – the absence of a dedicated waste segregation mechanism within these academic bastions.



Fig 5: Assorted bins for waste segregation at some locations in the campus

***A Call for Systematic Segregation***

Within this landscape, a clarion call arises for the implementation of systematic waste segregation practices. The journey from the academic sphere to the waste bin necessitates a crucial intermediate step: categorization. While the intent to manage waste responsibly is apparent, the crucial step of segregation remains to be fully realized.

***Pathways to Enhanced Solid Waste Management***

Navigating the path toward enhanced solid waste management, it becomes evident that a collective effort is indispensable. The mosaic of stakeholders, each with their unique approaches, converges toward a shared goal – sustainable waste management. Harnessing the momentum of awareness and collaboration, the university community can embark on a journey toward a more responsible, systematic, and effective waste management paradigm.

***A Sustainable Vision Unveiled***

As the university community unites its collective vision, a sustainable panorama emerges. It's a vista where waste management isn't merely a pragmatic necessity, but a reflection of shared values. With each stakeholder segment contributing its essence, a harmonious coexistence between academia and environmental stewardship is forged, casting a resplendent glow upon the institution's green audit journey.



Fig 6: Waste bins and collection centres of AMC in TU campus

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          | 42.0                               | 9.81       |
|   | Plastic waste        | 08.0                               | 1.87       |
|   | Organic Waste        | 35.0                               | 8.18       |
|   | E-waste              | 02.0                               | 0.47       |
| Administrative Office                   | Paper waste          | 20.0                               | 4.67       |
|   | Plastic waste        | 03.0                               | 0.70       |
|   | Organic Waste        | 12.0                               | 2.80       |
|   | E-waste              | 01.0                               | 0.23       |
| Residential Quarter/Hostels/ GuestHouse | Paper waste          | 50.0                               | 11.68      |
|   | Plastic waste        | 25.0                               | 5.84       |
|   | Organic Waste        | 200.0                              | 46.73      |
|   | E-waste              | 01.0                               | 0.23       |
| Canteens                                | Paper waste          | 05.0                               | 1.17       |
|   | Plastic waste        | 04.0                               | 0.93       |
|   | Organic Waste        | 20.0                               | 4.67       |
|   | E-waste              | 0.0                                | 0.00       |
| <b>TOTAL</b>                            |                      | 428 Kg /week                       |            |

***Sustainable Solid Waste Management***

Within the tapestry of sustainable practices, the University campus has embraced an evolving ethos of solid waste management, ushering in a harmonious coexistence between academia and environmental stewardship. A holistic approach finds resonance in the diverse practices adopted by various stakeholder segments, each weaving their unique contributions toward a shared goal – a greener, cleaner future.

***Distinctive Segregation Efforts***

Diving into the realm of waste management, an array of distinctive practices comes to light. The teacher's quarters stand as exemplars, maintaining individual personal dustbins for solid waste disposal and dedicated pits for organic waste. Remarkably, 40% of Academic Departments and 50% of residential quarters have embraced separate disposal systems for dry and wet waste, portraying a commitment to responsible waste management.

***Segmented Sorting Initiatives***

A nuanced practice emerges, one where biodegradable waste is segregated from its non-biodegradable counterparts. The realms of teacher's quarters, Guest House, and 20% of Academic Departments serve as bastions of this sorting endeavor, while hostels are yet to fully embrace this differentiation.

***Municipal Partnership and Composting***

A synergistic partnership with the Agartala Municipal Corporation (AMC) is central to the campus's waste management narrative. A staggering 90% of accumulated solid waste, excluding pit-dumped waste, is diligently collected by AMC every two days. This waste undergoes a transformative journey – a process of segregation and landfilling for some, while composting becomes the destiny for the rest.

**Championing Responsible Waste Recycling**

While the centralized system underpins effective waste management, an avenue remains untrodden – recycling. Currently dormant, the promise of recycling awaits activation, offering a realm of possibilities to further curtail the ecological footprint.

**Vermicomposting: Nature's Eloquent Solution**

In this narrative, vermicomposting emerges as a beacon of innovation and sustainability. Spearheaded by the expertise of the then Prof. Priyasankar Chaudhuri from the Department of Zoology, the university embraced this technology wholeheartedly. Organic waste, including leaves, terrestrial weeds, and kitchen scraps, undergoes a metamorphosis under the diligent care of earthworms.

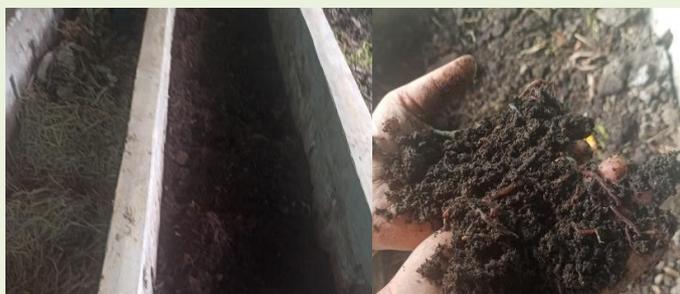


Fig. 7: Different organic wastes used for vermi-composting

**Earthworms as Catalysts of Change**

These earthworms, the *Perionyx excavatus* species, tirelessly transform the organic waste into vermicompost, nutrient-rich organic manure. This process, spanning a mere 45 days, exemplifies nature's efficiency and regenerative power. The pre-composted substrates, infused with earthworms, flourish within specially designed cemented tanks, culminating in the birth of nutrient-rich vermicompost.

**Fertile Harvest: A Gift to Gardens**

From the vermicomposting unit's basement, the fruits of this labour are ushered into flower gardens and Musambi gardens, nurturing sustainable agriculture. The campus comes full circle, as the vermicompost breathes life into the very spaces that foster its inception, contributing to the harmonious rhythm of nature.

**A Testament to Green Ingenuity**

In the vivid tapestry of green audit endeavors, the journey of solid waste management stands as a testament to the campus's commitment to sustainable practices. As waste is transformed into nourishment, the university's nurturing spirit extends to the environment, weaving a legacy that resonates with ecological balance and responsible coexistence.

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 ( $\mu\text{Mho cm}^{-1}$ ) | 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 ( $\text{mg } 100\text{g}^{-1}$ )    | 147.39  | 48.97  | 26.15   | 163.71  | 0.89 % (Total P) |
| Av. Potassium ( $\text{mg } 100\text{g}^{-1}$ )     | 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 University Campus

| Parameters  | C       | BC      | AC      | MC      | KW              |
|---|---------|---------|---------|---------|-----------------|
| pH  | 6.85    | 7.06    | 6.9     | 6.71    | 7.59            |
| Electrical conductivity ( $\mu\text{Mho cm}^{-1}$ ) | 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 ( $\text{mg } 100\text{g}^{-1}$ )    | 275.04  | 130.96  | 86.88   | 300.96  | 1.09% (Total P) |
| Av. Potassium ( $\text{mg } 100\text{g}^{-1}$ )     | 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

### Liquid waste management:

Within the symphony of sustainability, liquid waste management emerges as a pivotal crescendo in the University's green audit narrative. As the campus engages in scientific exploration, nourishment, and habitation, liquid waste from various sources shapes the ecological harmony. With a holistic perspective, the University seeks to orchestrate responsible liquid waste practices.

#### *Fluid Origins and Diversity*

Originating from diverse nodes of campus vitality, liquid waste paints a comprehensive mosaic. The conduits of liquid waste originate from the dynamic interplay of Science laboratories, Hostels, Residential quarters, and the bustling canteen. These intricate streams collectively weave a tapestry of environmental responsibility.

#### *Classifying Liquid Waste*

The University's liquid waste spectrum bifurcates into two distinct categories, each with its own nuances:

1. Sewage Waste: In the first category, sewage waste finds its place. This waste embodies the residues of everyday life, necessitating a meticulous approach to containment and treatment. As a crucial aspect of the campus's sustainability fabric, the management of sewage waste assumes paramount importance.
2. Laboratory, Residential Washing, and Canteen Effluents: The second category comprises laboratory liquids, residential washing effluents, and canteen discharges. An amalgam of academic pursuit, habitation, and nourishment, these effluents collectively contribute to the campus's liquid waste matrix.

#### *Responsible Disposal Pathways*

Embracing the ethos of sustainability, the campus navigates responsible disposal pathways for liquid waste. Laboratory liquids gracefully find their way to soak pits, ensuring an eco-conscious approach to disposal. Other liquid waste, with the intention of ameliorating the ground's water table, is directed through drainage channels.

#### *Towards a Sustainable Horizon*

Despite the commendable strides in responsible liquid waste management, the University acknowledges the need for comprehensive solutions. Presently devoid of a dedicated sewage treatment plant, the campus's vision is aligned with the creation of a holistic infrastructure that

nurtures liquid waste in an environmentally harmonious manner.

As liquid waste intertwines with the campus's journey towards sustainability, the commitment to stewardship remains unwavering. The University's aspirations echo the establishment of a framework that preserves, rejuvenates, and nurtures liquid waste with the same zeal that it approaches academia and research. In the fluidic embrace of sustainable practices, the campus envisions a greener future, harmonizing with the pulse of the planet.

### **Biomedical waste management**

In the tapestry of sustainability, the canvas of biomedical waste management unfurls as an intricate thread, meticulously woven into Tripura University's green audit narrative. As the campus engages in pioneering research, the responsible management of biomedical waste emerges as a key note in its eco-conscious symphony.

#### ***Unveiling Biomedical Waste***

Within the confines of the academic pursuit, certain faculties engage in research involving animals. This avenue, while limited in scale, births a trace of biomedical waste – a byproduct of progress. The insignificance of this waste volume underscores the University's commitment to ethical research practices.

#### ***A Transitory Dwelling***

In reverence to ethical and responsible waste management, the University treads a cautious path. The carcasses of these research animals find a transitory dwelling, stored within the icy grasp of -20°C temperatures. This interim refuge aligns with the University's commitment to maintaining the dignity of these beings and preserving them for their eventual journey towards responsible disposal.

#### ***Collaboration with Agartala Municipal Corporation***

Upon reaching an adequate threshold of collected waste, the University dons the mantle of responsibility. Handing over this biomedical waste baton to the Agartala Municipal Corporation ushers in the final act of this responsible journey. In this seamless handoff, the campus aligns with the broader civic ecosystem, ensuring that even this minor residue of research finds its rightful place in the realm of waste management.

#### ***Responsible Stewardship: Ethical Progress***

In the pursuit of academic excellence, Tripura University reiterates its dedication to responsible stewardship. While the volume of biomedical waste remains minute, the conscientious manner in which it is handled reflects the ethos of ethical progress. The University's commitment extends beyond research boundaries, culminating in an environmentally conscious partnership with the community.

As the curtains draw on the chapter of biomedical waste, Tripura University's green audit story resounds with the echoes of responsibility. In these seemingly trivial details lies a testament to the campus's overarching commitment to sustainability, ethics, and the harmonious coexistence of research and environmental consciousness.

### **E-waste management**

Within the pulsating heart of Tripura University's academic landscape, a silent symphony of technology plays out – a harmony of innovation, learning, and progress. Yet, within this rhythm, the University is attuned to the echo of a different cadence – that of e-waste management. In its quest for sustainable progress, the campus pioneers responsible stewardship of electronic remnants.

### ***Mapping the E-waste Terrain***

The digital tapestry that embellishes Tripura University's educational journey is interwoven with electronic wastes. These technological castaways originate from various precincts – computer laboratories, electronic labs, Physics Labs, Chemistry Lab, Biotech Labs, Academic and Administrative Offices. This intricate amalgam of e-waste paints a portrait of academia's evolving landscape, where the vestiges of progress reside.

### ***E-waste Ensemble***

In this digital symposium of waste, the ensemble of e-waste takes center stage. This ensemble comprises items that have reached the crossroads of their operational life – out-of-order equipment, obsolete lab instruments, circuitry, desktops, laptops, accessories, printers, cables, cartridges, and more. As technology journeys onward, these companions of the past find themselves cast aside, yearning for a fitting afterlife.

### ***Reuse, Recycle, Dispose***

Tripura University champions an efficient mechanism for e-waste's resolution. The ethos here embraces three key avenues – reuse, recycling, and responsible disposal. Wastes that still bear a spark of utility are given a second life, avoiding premature consignment to oblivion. Yet, for those beyond rejuvenation, the University collaborates with authorized vendors for their conscientious disposal. This partnership ensures that e-waste's voyage is navigated with a commitment to environmental consciousness.

As technology unfurls its wings towards constant evolution, the University stands at a crossroads – to acquire anew or to embrace the buy-back option for technology's metamorphosis. In a world where newness beckons, Tripura University champions a path of wisdom. The campus's choice echoes an ethos of sustainability, where the embrace of newness is balanced by the prudent management of its technological past.

### ***A Harmonious Technology Choreography***

In the dance of technology's rapid evolution, Tripura University orchestrates a harmonious choreography that resonates with e-waste's melody. As laboratories hum with scientific pursuits and offices pulsate with administrative rhythms, the campus acknowledges its responsibility towards the electronic companions that have served their purpose. Through the tapestry of e-waste management, the University contributes its notes to the symphony of sustainable progress.

### ***Hazardous Waste***

Within the intricate tapestry of waste management, the thread of hazardous waste requires a discerning hand and an informed mind. Tripura University, nestled in the embrace of knowledge, confronts the nuances of hazardous waste management with a blend of understanding and action.

### ***Regulatory Pathways and Unique Challenges***

In the realm of hazardous waste, the Ministry of Environment, Forest and Climate Change, Government of India, presides as the custodian of regulations. The Hazardous Waste (Management and Handling) Rules, 1989, evolved into the more comprehensive "Hazardous waste (Management, Handling, and Trans-boundary Movement) Rules, 2008." Amid this regulatory landscape, Tripura University stands as a conscientious steward, embracing its responsibility.

### *Unique Context of Hazardous Waste at the University*

Within the University's academic embrace, hazardous waste assumes a diverse identity. While some departments generate substantial quantities, others align with the classification of conditionally exempt small quantity generators. This category encompasses those generating less than 100 grams of hazardous waste per month. Amid this diversity, awareness and compliance intertwine – some stakeholders may not fully grasp their obligations under these regulations.

### *Weaving Knowledge into Action: Understanding Hazards*

The crux of effective hazardous waste management lies in understanding potential hazards. Within the campus's academic alcoves and laboratories, knowledge is key. Stakeholders are entrusted with disseminating information on hazardous materials – their reactivity and potential health implications. This conscious dissemination knits a fabric of informed action.

### *Navigating the Maze: Disposal Uncertainties*

While knowledge serves as the compass, disposal often remains a terrain of uncertainties. Tripura University's Green Audit Committee embarked on a survey that revealed an intricate web of understanding and uncertainty among respondents. A majority displayed an understanding of hazardous waste, yet uncertainty clouded the path of its disposal. Green initiatives designed to manage hazardous waste found themselves ensnared in a shroud of unfamiliarity.

### *Challenges and a Call for Progress*

As the University's academic clock ticks, hazardous waste's clockwork presents challenges. The blend of variety and small quantities underscores the complexity. The data echoes a tale where household batteries emerge as the most frequently disposed hazardous waste, followed by household and office cleaners, pesticides, and wood preservatives – each slipping into disposal channels in measured quantities.

### *A Quest for Sustainable Resolution*

Yet, within this journey of challenges, a quest for resolution emerges. Tripura University's embrace of hazardous waste management pivots on responsible handling and transportation to approved treatment facilities. While challenges pepper this path – financial needs for external handling and on-site coordination, the diversity of waste types, and small quantities – the University stands firm, acknowledging its role in this orchestration.

### *Orchestrating a Harmonious Campus*

As the University's corridors witness the ebb and flow of knowledge, hazardous waste becomes an adjunct to this symphony. The resonance of understanding, the clarion call of awareness, and the rhythm of responsible management harmonize into a tapestry where hazardous waste finds its rightful place. Amid laboratories and academic buildings, Tripura University leads a quest that resonates with responsibility, knowledge, and sustainable progress.

### **Observation**

Amid the sprawling expanse of Tripura University's campus, the Green Audit has unveiled valuable insights that map the trajectory of sustainability. These observations resonate with both progress and potential, setting the stage for conscientious action.

- ❖ **Harmonizing Biomedical Waste Disposal:** In the laboratories' humming heartbeats, biomedical waste emerges as a focal point. The audit shines a light on the need for a more

streamlined disposal system. This revelation calls for a symphony where every biomedical waste molecule finds its rightful place in the grand orchestration of waste management.

- ❖ **Nurturing Liquid Hazardous Waste:** As the campus pulsates with academic fervor, liquid hazardous waste seeks a more appropriate disposal path. This observation taps into the essence of responsibility, urging the adoption of practices that safeguard both the campus's vitality and the environment's well-being.
- ❖ **Towards a Plastic-Free Haven:** In a world dominated by plastic, Tripura University is carving its own path. Initiatives have been germinating to weave the campus into a plastic-free haven. This step, though commendable, beckons for collective effort and awareness, a joint endeavor to birth a plastic-free legacy.
- ❖ **Vermi-Composting: Growing Towards Fulfillment:** The campus's green ambitions embrace vermi-composting, a step towards sustainable transformation. Yet, the observation notes a gap between the aspiration and the full realization of vermi-composting's potential. The soil's voice yearns for more organic sustenance.

### Suggestions

From these observations, recommendations bloom like buds, promising a verdant future.

- ❖ **Championing Biodegradable Alternatives:** The heart of sustainability beats within the choice of materials. The realm of biodegradable alternatives stands ready to be championed. This recommendation becomes a call to action, a shift towards materials that breathe in harmony with nature.
- ❖ **Nurturing Vermi-Composting Potential:** The landscape of vermi-composting holds untapped potential, promising to meet the campus's organic cravings. By nurturing this potential, Tripura University can nurture both the soil and its aspirations.
- ❖ **Guiding Liquid Hazardous Waste:** The laboratories' pursuits paint the canvas of discovery, but liquid hazardous waste requires a guided journey beyond campus confines. The recommendation echoes the need for a well-mapped route to off-campus disposal facilities.
- ❖ **Unveiling Paper Recycling's Potential:** Among the rustling pages of academia lies a story of paper. The recommendation suggests embracing a centralized system of paper recycling, weaving the campus into a narrative where paper's life cycles are revered.
- ❖ **Igniting the Incinerator Option:** In the campus's tapestry, an incinerator awaits ignition. This recommendation envisions the installation of an incinerator, a guardian of proper waste disposal that breathes a cleaner future.
- ❖ **The Green Audit's observations and recommendations intertwine, shaping a narrative of transformation. Each observation, a compass pointing north, and each recommendation, a beacon lighting the way. As Tripura University embarks on this journey, the seeds of change are sown, fostering a legacy where sustainability blooms in every corner of the campus.**



**Biodiversity audit**

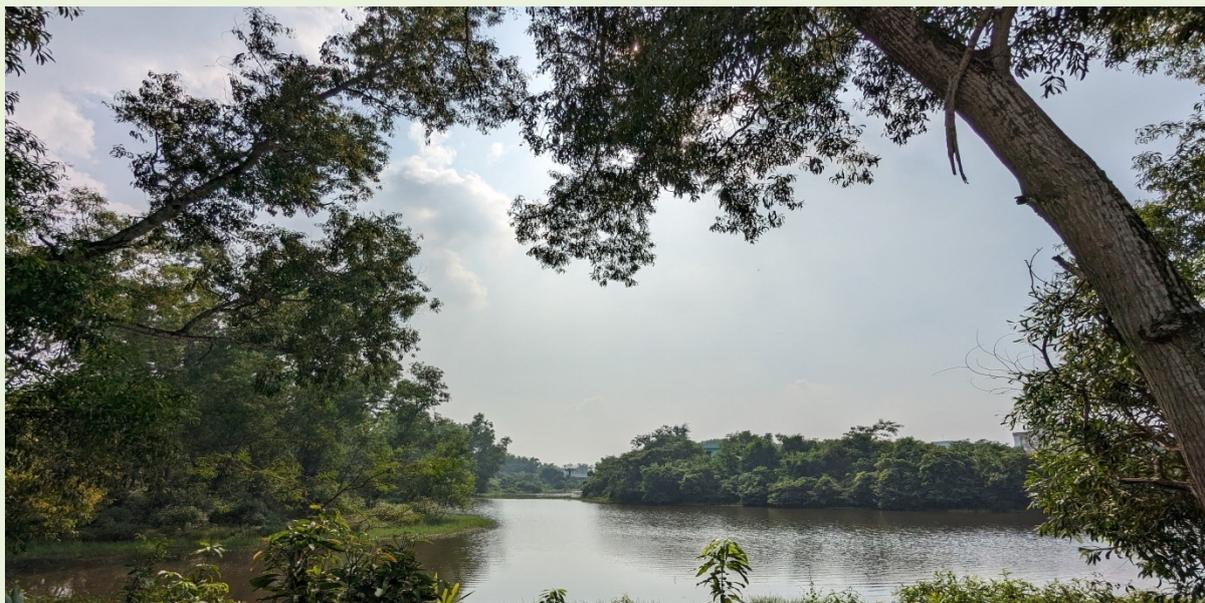
Nestled within the serene embrace of Tripura University's campus, an ongoing narrative of life unfolds through the Biodiversity Audit. This unfolding saga is a testament to the collective efforts of faculty members, researchers, and students who, for years, have been the stewards of this living biota and its preservation. In this harmonious journey, the University takes on the role of a custodian, orchestrating various conservation practices that curtail the impact of human activities on biodiversity and the intricate ecosystems that thrive here.

Scientific knowledge and a comprehensive database, cultivated through dedicated studies and research conducted by the Departments of Botany, Zoology, Forestry and Biodiversity, underpin the narrative. Despite challenges, this compilation has given rise to an authentic documentation, offering a glimpse into the intricate interplay of biodiversity and the natural ecosystem that grace the campus. These endeavors are complemented by an array of conservation practices that act as brushstrokes, crafting a canvas of sustainability and vitality.

***A Journey of Exploration***

The Biodiversity Audit unfolds with a fundamental goal: to map and chronicle the many facets of biodiversity that populate the institution's domain. Ecosystem structures and functions are observed, and the pulse of biodiversity is monitored diligently across its diverse domains.

The campus's vibrant palette is enriched by a tranquil lake that glistens like a jewel. What was once an untouched waterbody has evolved into a hub of vitality, extending its reach to nurture both the land and its inhabitants. This aqueous oasis serves as a haven for migratory birds and playful fishes during the rainy season. Beyond aesthetics, it provides irrigation to nearby fields and becomes a canvas for cultural events, enhancing the campus's allure.



Within this symphony, a myriad of life forms takes center stage. From the sky to the ground, an array of creatures contributes to the harmonious chorus. These include birds, mammals, and more, their coexistence enriching the campus's tapestry.

Nature's palette finds expression through a myriad of flora. Orchestrated by Prof. Badal K Datta and his team of scholars, studies have unveiled the intricate floral diversity that graces the campus. From towering trees to delicate blooms, a rich botanical ensemble paints the landscape.

### **Faunal and Floral Diversity**

Tripura University's Biodiversity Audit is a testament to the harmonious coexistence of life forms within its sprawling confines. Through meticulous documentation and conscientious conservation, the University nurtures a campus that thrives as a sanctuary of biodiversity. This enduring endeavor, woven into the very fabric of the institution, ensures that the melodies of life echo through generations, forging a legacy of sustainability and unity with nature. A voyage of discovery unfolded, encapsulating the essence of the Biodiversity Audit. This annual expedition culminated in a comprehensive documentation of the campus's diverse biota.

The campus becomes a canvas upon which faunal and floral diversity express themselves. The table of faunal diversity, elegantly summarized in Table 8, captures the essence of coexisting life forms. Likewise, Table 9, based on the research efforts of Prof. Badal K Datta and his team, illustrates the floral richness that adorns the campus.

#### ***Faunal diversity***

The faunal diversity under different species groups are listed in Table 8.

#### ***Floral diversity***

The floral diversity under different species groups are listed in Table 9. The list is based on the studies carried out by Prof. Badal K Datta and his team of scholars.

Table 8: Faunal diversity in the TU campus

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

| 10.                                     | Gonya                          | <i>Labeo goni</i>                    |
|---|--------------------------------|--------------------------------------|
| 11.                                     | Rui                            | <i>Labeo rohita</i>                  |
| 12.                                     | Puti                           | <i>Puntius chola</i>                 |
| 13.                                     | Boal                           | <i>Wallago attu</i>                  |
| 14.                                     | Katla                          | <i>Catla catla</i>                   |
| 15.                                     | Karfu                          | <i>Cyprinus carpio</i>               |
| <b>Tree Shrews, moles and squirrels</b> |                                |                                      |
| 1.                                      | Northern Tree Shrew            | <i>Tupaia belangeri</i>              |
| 2.                                      | House Shrew                    | <i>Suncus murinus</i>                |
| 3.                                      | White Toothed Shrew            | <i>Suncus etruscus</i>               |
| 4.                                      | Hairy Belied Squirrel          | <i>Callosciurus pygerythrus</i>      |
| 5.                                      | Indian Long Tailed Field Mouse | <i>Apodemus sylvaticus</i>           |
| <b>Avifauna</b>                         |                                |                                      |
| Sl. No.                                 | Common Name                    | Scientific Name                      |
| 1.                                      | Lesser Whistling Teal          | <i>Dendrocygna javanica</i>          |
| 2.                                      | Asian Openbill Stork           | <i>Anastomus oscitans</i>            |
| 3.                                      | Indian Pond Heron              | <i>Ardeola grayii</i>                |
| 4.                                      | Little Egret                   | <i>Egretta garzetta</i>              |
| 5.                                      | Little Cormorant               | <i>Phalacrocorax niger</i>           |
| 6.                                      | Black Kite                     | <i>Milvus migrans</i>                |
| 7.                                      | Common Moorhen                 | <i>Gallinula chloropus</i>           |
| 8.                                      | Bronze Winged Jacana           | <i>Metopidius indicus</i>            |
| 9.                                      | Common Kingfisher              | <i>Alcedo atthis</i>                 |
| 10.                                     | White-throated Kingfisher      | <i>Halcyon smyrnensis</i>            |
| 11.                                     | Common Pigeon                  | <i>Columba livia</i>                 |
| 12.                                     | Green bee-eater                | <i>Merops orientalis</i>             |
| 13.                                     | Common Myna                    | <i>Acridotheres tristis</i>          |
| 14.                                     | Red vented Bulbul              | <i>Pycnonotus cafer</i>              |
| 15.                                     | Oriental Magpie Robin          | <i>Copsychus saularis</i>            |
| 16.                                     | Black Drongo                   | <i>Dicrurus macrocercus</i>          |
| 17.                                     | Asian Pied Myna                | <i>Gracupica contra</i>              |
| 18.                                     | House Sparrow                  | <i>Passer domesticus</i>             |
| 19.                                     | Eurasian Tree Sparrow          | <i>Passer montanus</i>               |
| 20.                                     | Spotted Dove                   | <i>Spilopelia chinensis</i>          |
| 21.                                     | Green-billed Malkoha           | <i>Phaenicophaeus tristis</i>        |
| 22.                                     | Eastern Jungle Crow            | <i>Corvus levaillantii</i>           |
| 23.                                     | Greater Flameback              | <i>Chrysocolaptes guttacristatus</i> |
| 24.                                     | Black-hooded Oriole            | <i>Oriolus xanthornus</i>            |
| 25.                                     | Asian Palm Swift               | <i>Cypsiurus balasiensis</i>         |
| 26.                                     | Lineated Barbet                | <i>Megalaima lineata</i>             |
| 27.                                     | Common Goldenback              | <i>Dinopium javanense</i>            |
| 28.                                     | Stork-billed kingfisher        | <i>Pelargopsis capensis</i>          |
| 29.                                     | Grey-headed fish eagle         | <i>Haliaeetus ichthyaeus</i>         |
| 30.                                     | Rufous-necked laughingthrush   | <i>Pterorhinus ruficollis</i>        |
| 31.                                     | Chestnut-tailed starling       | <i>Sturnia malabarica</i>            |
| 32.                                     | Purple sunbird                 | <i>Cinnyris asiaticus</i>            |
| 33.                                     | Rose-ringed parakeet           | <i>Psittacula krameri</i>            |
| 34.                                     | Barn owl                       | <i>Tyto alba</i>                     |

|     |                     |                              |
|-----|---------------------|------------------------------|
| 35. | Spotted owl         | <i>Athene brama</i>          |
| 36. | Oriental White Eye  | <i>Zosterops palpebrosus</i> |
| 37. | Red Wattled Lapwing | <i>Vanellus indicus</i>      |
| 38. | Spotted Dove        | <i>Spilopelia chinensis</i>  |

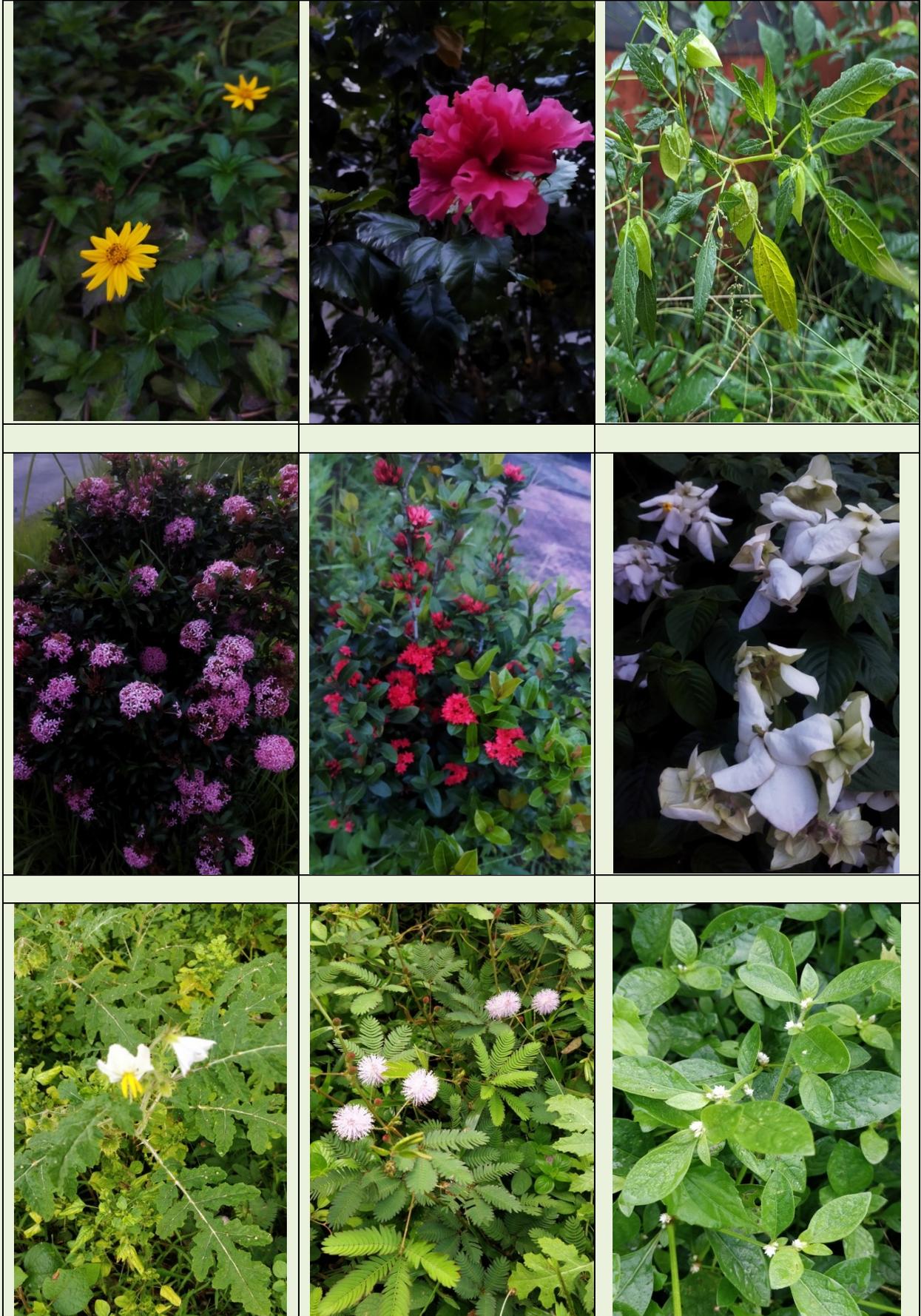
Table 9 Summary of some recorded Flora in Tripura University campus

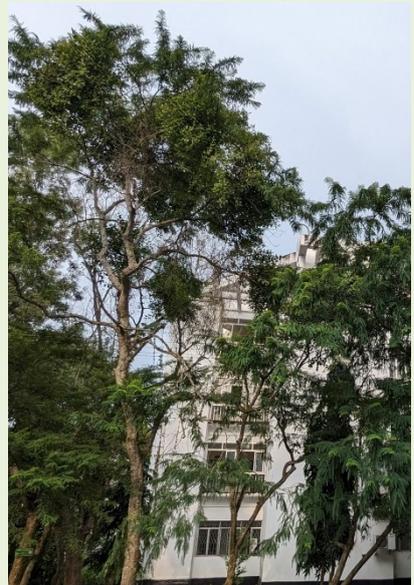
| Sl. No. | Scientific Name                                  | Local name       | Family         |
|---------|--|------------------|----------------|
| 1       | <i>Acacia auriculiformis</i> A. Cunn. ex Benth.  | Akashmoni        | Mimosaceae     |
| 2       | <i>Ageratum conyzoides</i> L.                    | Durkhi           | Asteraceae     |
| 3       | <i>Ageratum houstonianum</i> Mill.               | Durkhi           | Asteraceae     |
| 4       | <i>Ailanthus integrifolia</i> Lam. ex Steud      | White Siris      | Simaroubaceae  |
| 5       | <i>Albizia lebbek</i> (L.) Benth.                | Koroi            | Mimosaceae     |
| 6       | <i>Alstonia scholaris</i> (L.) R.Br.             | Chatim           | Apocynaceae    |
| 7       | <i>Alternanthera sessilis</i> (L.) R. Br. ex DC. | Matti Khanduri   | Amaranthaceae  |
| 8       | <i>Anacardium occidentale</i> L.                 | Kaju             | Anacardiaceae  |
| 9       | <i>Annona reticulata</i> Sieber ex A.DC.         | Ataphal          | Annonaceae     |
| 10      | <i>Anthocephalus chinensis</i> Hassk.            | Kadam            | Rubiaceae      |
| 11      | <i>Antidesma ghaesembilla</i> Gaertn.            | Elena /khudi jam | Phyllanthaceae |
| 12      | <i>Aquilaria malaccensis</i> Roxb.               | Agor             | Thymelaeaceae  |
| 13      | <i>Araucaria columnaris</i> Hook.                | Christmas tree   | Araucariaceae  |
| 14      | <i>Artocarpus heterophyllus</i> Lam.             | Kathal           | Moraceae       |
| 15      | <i>Averrhoa carambola</i> L.                     | Kamranga         | Oxalidaceae    |
| 16      | <i>Azadirachta indica</i> A. Juss.               | Neem             | Meliaceae      |
| 17      | <i>Bauhinia variegata</i> L                      | Raktokanchan     | Fabaceae       |
| 18      | <i>Bombax insigne</i> Wall.                      | Semal            | Bombacaceae    |
| 19      | <i>Borassus flabellifer</i> L.                   | Tal              | Arecaceae      |
| 20      | <i>Caesalpinia bonduc</i> (L.) Roxb.             | Ghagragota       | Caesalpinaceae |
| 21      | <i>Caesalpinia pulcherrima</i> (L.) Sw.          | Radhacura        | Caesalpinaceae |
| 22      | <i>Callistemon lanceolatus</i> (Sm.) Sweet       | Bottle-brush     | Myrtaceae      |
| 23      | <i>Careya arborea</i> Roxb.                      | Kumvira          | Lecythidaceae  |
| 24      | <i>Carica papaya</i> L.                          | Pepe             | Caricaceae     |
| 25      | <i>Cassia fistula</i> L.                         | Bandor lathi     | Mimosaceae     |
| 26      | <i>Cassia siamea</i> Lam.                        | Cassia           | Mimosaceae     |
| 27      | <i>Chenopodium album</i> L.                      | Betho –shak      | Amaranthaceae  |
| 28      | <i>Citrus limon</i> (L.) Osbeck                  | Lebu             | Rutaceae       |
| 29      | <i>Citrus maxima</i> (Burm.) Merr.               | Jambura          | Rutaceae       |
| 30      | <i>Citrus reticulata</i> Blanco                  | Komala           | Rutaceae       |
| 31      | <i>Clausena heptaphylla</i> (Roxb.) Wight & Arn. | Karanphul        | Rutaceae       |
| 32      | <i>Cocos nucifera</i> L.                         | Narikal          | Arecaceae      |
| 33      | <i>Dalbergia lanceolaria</i> L.f.                | Koroi            | Papilionaceae  |
| 34      | <i>Delonix regia</i> (Bojer) Raf.                | Krishna chura    | Caesalpinaceae |
| 35      | <i>Dendrophthoe falcata</i> (L.f.) Ettingsh.     | Dhaira ful       | Loranthaceae   |
| 36      | <i>Dillenia pentagyna</i> Roxb.                  | Chalita          | Dilleniaceae   |
| 37      | <i>Diospyros montana</i> Roxb.                   | Gaub             | Ebenaceae      |
| 38      | <i>Elaeocarpus floribundus</i> Blume             | Jolpai           | Elaeocarpaceae |
| 39      | <i>Engelhardia spicata</i> Lesch. ex Blume       | Tokiseleng       | Juglandaceae   |
| 40      | <i>Eucalyptus citriodora</i> Hook.               | Eucalyptus       | Myrtaceae      |
| 41      | <i>Eucalyptus globosus</i> Labill.               | Eucalyptus       | Myrtaceae      |

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

Floral Diversity Pictorial







Some Glimses of Biodiversity Rich Green Campus





Green campus initiatives

Green Campus



## Snag Trees and Their Ecological Tapestry

Amidst the verdant expanse of Tripura University's campus lies a fascinating phenomenon – the world of snag trees. These are not mere decaying remnants but are nature's abodes, revered as wildlife trees. These lifeless sentinels of the forest carry great significance, serving as refuge and sustenance for a myriad of wild creatures. This tapestry of biodiversity is intricately woven around dying trees, standing dead trees (snags), and the fallen wood that litters the forest floor. Their presence contributes to the symphony of life and the structural complexity of ecosystems, as illuminated by ecological research (Harm et al., 1986; Franklin, 1988).

A meticulous survey of Tripura University's campus unveiled a treasure trove of 32 snags. These silent sentinels, scattered across the landscape, foster an astonishing diversity of animal life. Among the beneficiaries are the acrobatic squirrels, the enigmatic owlets, the cooing doves, the chatty mynas, the vibrant parakeets, and the resonant barbets. Woodpeckers, geckos, and house lizards find haven amidst these natural shelters. Yet, the tale doesn't end here. A plethora of species, from snakes to spiders, from scorpions to ants, and even moths and beetles' caterpillars, contribute to this intricate ecosystem. The interplay of life and decay, predator and prey, unfolds within this dynamic microcosm.

Amidst this ballet of existence, the snag trees play an indispensable role. They are not just remnants; they are the architects of life's theater, proving that death and life are interwoven threads in nature's grand tapestry. These trees are far from lifeless; they are reservoirs of sustenance, homes, and sanctuaries, providing a stage for the myriad actors that make up the vibrant drama of the forest.

## Tree Diversity and Carbon Management

Within the heart of Tripura University's sprawling campus, a silent symphony of nature unfolds – a testament to the profound role trees play in shaping terrestrial ecosystems. These towering sentinels don many hats, including the crucial task of carbon accumulation. The dedicated team from the Department of Forestry and Biodiversity embarked on an illuminating exploration of the university's tree diversity potential, unearthing a wealth of insights that ripple through the campus's green fabric.

Their study, a rich tapestry of assessments, encompassed tree species richness, standing biomass, and the carbon stock held within these arboreal giants. An impressive array of 66 tree species, comprising 1301 individuals (40.69 individual ha<sup>-1</sup>), was meticulously identified across 56 genera and 32 families. This intricate puzzle coalesced into a total biomass of 377.76 metric tons spanning the entire area, translating to 11.82 metric tons ha<sup>-1</sup>, with carbon content at 5.91 metric tons ha<sup>-1</sup>. Remarkably, *Acacia auriculiformis* stood out as a titan contributor to biomass, its numerous individuals ensuring its significance.

The richness of tree species within the campus reverberates as a vital thread in the intricate fabric of carbon management. Trees such as *Anacardium occidentale*, *Artocarpus heterophyllus*, *Cassia siamea*, *Mangifera indica*, and *Sapindus mukorossi* stand out as prime candidates for landscape design, embodying qualities like expansive size, high carbon sequestration potential, and aesthetic allure. Through the strategic planting of trees, the campus undergoes a remarkable metamorphosis, transformed into a verdant oasis that tames ambient temperatures and purifies the air. This organic haven, adorned with diverse flora, breathes life into the landscape. The study reverberates with a plea for thoughtful conservation strategies – from venerable old trees to the nascent saplings – ensuring a continuum of growth, further elevating carbon storage potential.

In the intricate narrative of the campus's ecology, this work emerges as a cornerstone, championing the pivotal role of tree species. It crafts a foundational understanding, poised to guide future endeavours and safeguard the well-being of Tripura University's vibrant treescape.

### *Enriching Biodiversity at Tripura University*

Envision stepping onto the verdant canvas of Tripura University's campus – a haven where vibrant flora and diverse fauna entwine, creating an enchanting tapestry of life. The campus boasts a living symphony of nature, bustling with countless stories etched by every leaf, bloom, and fluttering wing.

Yet, amid this resplendent tapestry, certain observations urge us to recalibrate our approach to preserve and nurture this rich biodiversity.

#### **Observations**

- ❖ **A Verdant Eden:** The Tripura University Campus is an oasis of greenery, characterized by its thriving floral and faunal diversity. This vibrant environment is the hallmark of a thriving ecosystem, inviting all to partake in its beauty.
- ❖ **Safeguarding Trees:** However, an undertone of concern persists as the precious trees – pillars of this living canvas – sometimes face neglect. Untimely felling for construction purposes leaves a void in this ecosystem, reminding us of the delicate balance between development and conservation.
- ❖ **Unwelcome Invaders:** The monsoon's life-giving rain showers birth a challenge in the form of invasive species and overgrown weeds. While the rains rejuvenate, they also foster the growth of these intruders, altering the natural harmony of the ecosystem.

#### **Suggestions and Recommendations**

- ❖ **Tending to Eden:** The campus's lush ecosystem deserves careful stewardship. A comprehensive management strategy, attuned to ecological dynamics, is essential. Thoughtful planning and practices will ensure that the flora and fauna flourish in harmony.
- ❖ **Preserving Wetland Beauty:** The serene lake, nestled within the campus, stands as a sentinel of wetland beauty. Conservation and maintenance efforts must be amplified to protect this vital water body, preserving its role as a sanctuary for aquatic life and a retreat for migratory birds.
- ❖ **Crafting a Green Vision:** A panoramic view of the campus's future is essential. A sustainable and long-term landscape plan should dictate the distribution and types of vegetation. This strategy will safeguard the thriving trees and diverse flora, fostering a legacy of green for generations to come.

As we reflect on these insights, we're reminded that the Tripura University campus is not just a place of learning, but a canvas where nature and knowledge unite. Through thoughtful care, strategic planning, and a shared commitment, we can uphold the campus's vibrant biodiversity, creating a harmonious haven for both learning and life.

## Summary

Green auditing, a pivotal process for gauging eco-friendly and sustainable practices, took center stage at Tripura University during its third annual "Green Audit" for the year 2022-2023. This initiative was driven by the university's commitment to green practices and aimed at formulating an informed audit report.

The audit embarked on an exhaustive journey, commencing with evaluating vegetative cover, waste management, water usage, and other essential aspects. The audit team meticulously examined diverse facilities on campus, identifying consumption patterns and their environmental implications. Through on-site visits and direct accounting, data collection in sectors like water, waste, and biodiversity status formed the cornerstone of this comprehensive audit.

Key findings highlighted the sprawling 97-acre campus, including 75 acres within the main area and an additional 22-acre expansion in 2015. Orchards, wetlands, botanical gardens, and more contributed to the campus's vibrant ecosystem. However, challenges like wetland siltation and vegetational reduction due to developmental activities were noted.

The audit delved into water usage, assessing intake, treatment, and reuse facilities. While potable water quality adhered to standards, wastewater management posed concerns. Rainwater harvesting, facilitated by a natural lake, presented opportunities for enhanced systems within buildings.

Waste management practices were scrutinized, and effective strategies were recommended. The generation of 428 kg of solid waste per week prompted a review of disposal methods. Notably, composting initiatives and segregated disposal systems showcased the university's commitment to sustainable waste management.

Hazardous waste management received attention, despite small quantities. A majority of stakeholders demonstrated awareness of hazardous waste disposal regulations. However, transportation to approved treatment facilities was emphasized. Liquid waste management challenges, including laboratory waste, underscored the need for better handling and off-campus treatment options.

E-waste management stood as a model of efficiency, with meticulous recycling and authorized disposal. The adoption of buy-back options for technology upgrades showcased the university's commitment to eco-conscious practices.

Furthermore, the audit embraced biodiversity, emphasizing the continuous efforts of faculty, researchers, and students to assess and conserve campus biota. The campus, spanning 97 acres, hosted diverse fauna and flora, contributing to a rich ecosystem.

In conclusion, the Green Audit Report-2022-23 emerges as a guiding beacon for Tripura University's sustainable development. The comprehensive observations, suggestions, and recommendations underscore a holistic approach to campus eco-friendliness. This audit report is poised to shape university policies, ushering in a new era of impactful environmental conservation and global sustainability.

**Appendix-I**

**Green/Energy/Environmental Audit Questionnaire - Tripura University**

**Stakeholder Survey**

*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/Department has conducted any 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 minimize the loss of water during storage:

|     |  |    |  |
|-----|--|----|--|
| Yes |  | No |  |
|-----|--|----|--|

b) Whether TU 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 | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|

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

|     |                          |    |                          |            |                          |
|-----|--------------------------|----|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|------------|--------------------------|

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 | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|

g) Whether TU has adequate/ sufficient drainage system:

|     |                          |    |                          |
|-----|--------------------------|----|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|

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

|     |                          |    |                          |
|-----|--------------------------|----|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|

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 | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|

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

|     |                          |    |                          |       |                          |
|-----|--------------------------|----|--------------------------|-------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|

c) Whether TU has efficient water heating system:

|     |                          |    |                          |       |                          |            |                          |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|

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 | <input type="checkbox"/> | No | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|

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

|     |                          |    |                          |            |                          |
|-----|--------------------------|----|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|------------|--------------------------|

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 | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|

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? (eg., 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 conservation strategies or practices implemented within Tripura University?

|     |    |
|-----|----|
| 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 | <input type="checkbox"/> | Private | <input type="checkbox"/> | Walking | <input type="checkbox"/> |
|--------|--------------------------|---------|--------------------------|---------|--------------------------|

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

|                    |                          |                       |                          |
|--------------------|--------------------------|-----------------------|--------------------------|
| 4 Wheeler with CNG | <input type="checkbox"/> | 4 Wheeler without CNG | <input type="checkbox"/> |
| 2 Wheeler          | <input type="checkbox"/> | Bicycle               | <input type="checkbox"/> |

**Section 5: Waste Management and Sustainability**

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

|               |                          |                   |                          |              |                          |
|---------------|--------------------------|-------------------|--------------------------|--------------|--------------------------|
| Very Familiar | <input type="checkbox"/> | Somewhat Familiar | <input type="checkbox"/> | Not Familiar | <input type="checkbox"/> |
|---------------|--------------------------|-------------------|--------------------------|--------------|--------------------------|

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

|     |                          |    |                          |       |                          |            |                          |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|

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

|     |                          |    |                          |
|-----|--------------------------|----|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|

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

|     |                          |    |                          |       |                          |            |                          |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|

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

|     |                          |    |                          |       |                          |            |                          |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|

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

|     |                          |    |                          |       |                          |            |                          |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|

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

|     |                          |    |                          |            |                          |
|-----|--------------------------|----|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|------------|--------------------------|

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

|     |                          |    |                          |            |                          |
|-----|--------------------------|----|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|------------|--------------------------|

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

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

|     |                          |    |                          |       |                          |            |                          |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|

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 | <input type="checkbox"/> | No | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|------------|--------------------------|

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

|     |                          |    |                          |            |                          |
|-----|--------------------------|----|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|------------|--------------------------|

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 | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|

**Section 6: Biodiversity and Land Use**

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

|     |                          |    |                          |
|-----|--------------------------|----|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|

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

|     |                          |    |                          |       |                          |            |                          |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|

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

|     |                          |    |                          |
|-----|--------------------------|----|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|

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

|     |                          |    |                          |
|-----|--------------------------|----|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|

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

|     |                          |    |                          |       |                          |            |                          |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Maybe | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|-------|--------------------------|------------|--------------------------|

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 | <input type="checkbox"/> | No | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|------------|--------------------------|

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

|     |                          |    |                          |            |                          |
|-----|--------------------------|----|--------------------------|------------|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Don't know | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|------------|--------------------------|

**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?

---

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*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.*

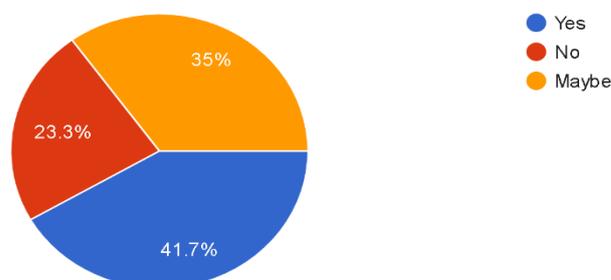
## Appendix-II

This section contains an 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 is distributed in various sections of the complete questionnaire set attached as **Appendix-I**. The responses have revealed various strengths such as conduction of awareness program within and outside the campus, maintenance of botanical garden and forest park, use of alternate energy sources, active stakeholder participation in plantation drives, formation of '*Vasudha*' environmental club, maintenance of floral and faunal diversity, assimilation of organic waste to vermicomposts to mention a few. However, there also exist some loopholes which need to be overcome in the upcoming years.

The following four 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 major portion of the stakeholders has given positive responses while still a large portion are unsure of the mentioned activities. However, we observe that a small yet not to be neglected portion has given negative response. This calls for a greater emphasis on reaching out to each and every stakeholder, motivating them and guiding them to be environmental/ green stewards.

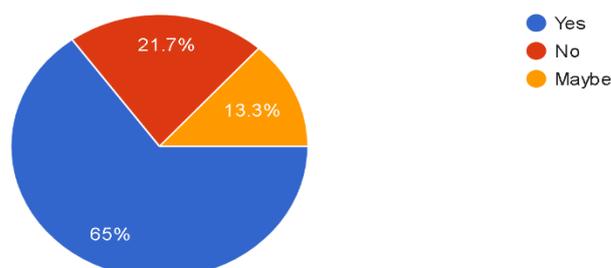
a) Whether TU/ department has conducted any awareness/ sensitization programme among the staff/ student members:

60 responses



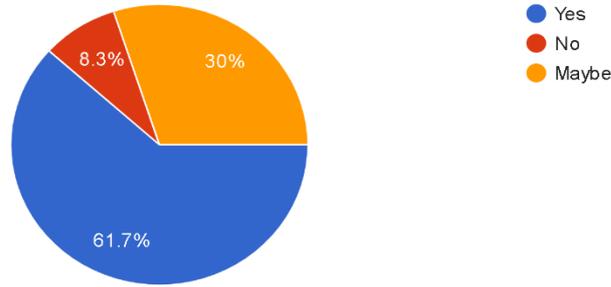
b) Whether all the departments/ teachers/ non-teaching members/ students are aware about the need of the environmental protection and audit:

60 responses



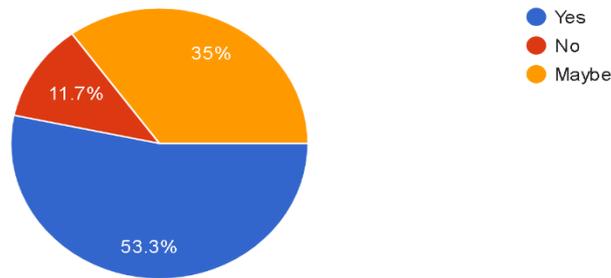
c) Whether TU has involved the students as volunteers in green activities/ programmes:

60 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:

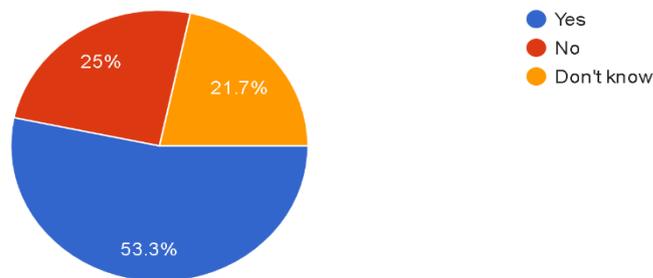
60 responses



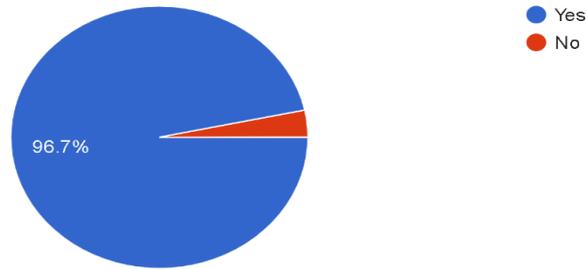
Responsible and judicious consumption and management of resources is a very commendable feature in the Tripura University campus. Some stakeholders have pointed out the need for implementation or creation of rainwater harvesting facilities in the campus. Meanwhile one stakeholder has reiterated that everyone must use water only at the required volume judiciously and prevent from wastage. The stakeholders gave their opinions on alternate energy/ green energy sources and also expressed their motivation in saving of energy sources. The responses also give motivation to the university to make efforts for residues and waste management and recycling. Some relevant questions along with responses are given as under:

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

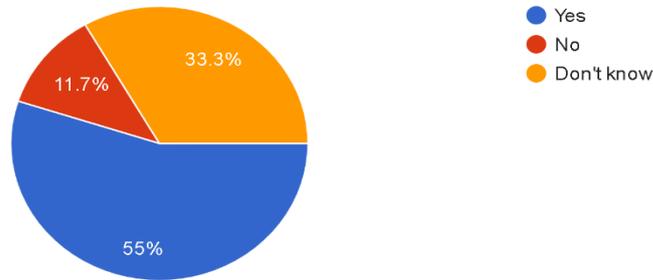
60 responses



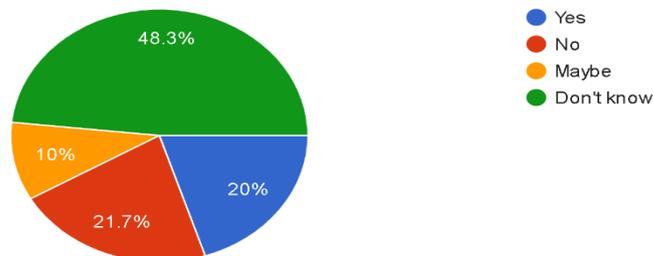
b) Whether TU has installed/ is using water filter with RO, Aqua Guard and/ or large water filter with cooler at strategic locations such as in the departm.../ Central library/ other centres within the campus:  
60 responses



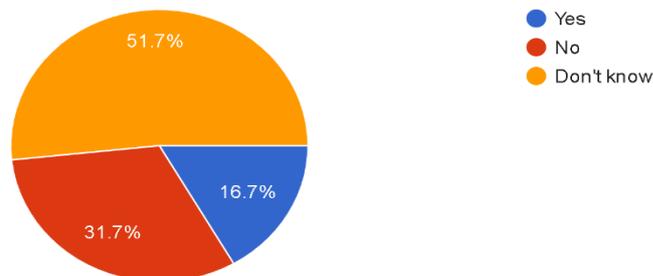
c) Whether TU has its own mechanism and/ or technical personnel to repair water leakage/ carry out routine inspection:  
60 responses



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

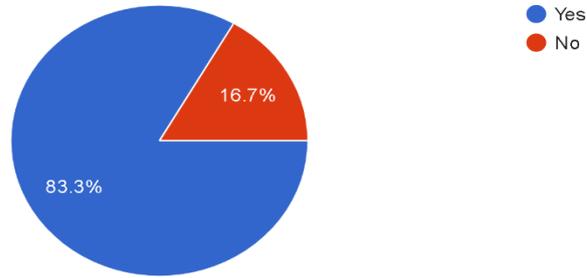


e) Whether TU has developed/ is developing a system for reuse and recycle of water:  
60 responses



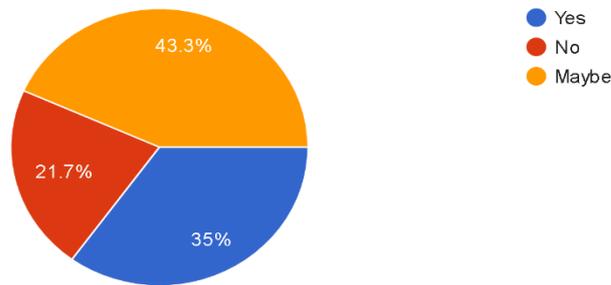
**g) Whether TU has adequate/ sufficient drainage system:**

60 responses



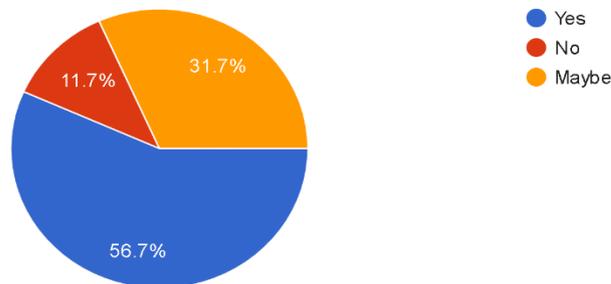
**a) Whether TU has any provision/ choice of renewable and carbon-neutral electricity options:**

60 responses



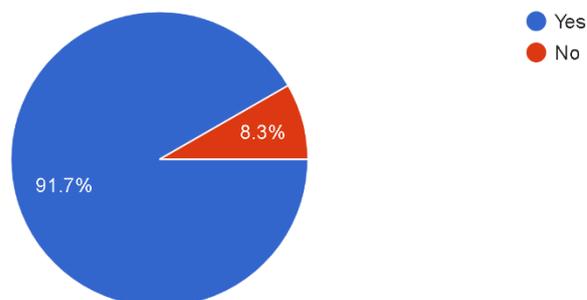
**b) Whether TU is planning/ has installed solar panels for harnessing solar energy:**

60 responses



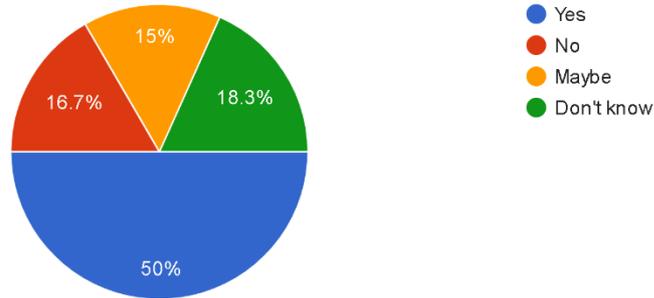
**d) Whether you are concerned in turning off electrical appliances when not in use in either institutional and/ or commercial and/ or residential area:**

60 responses



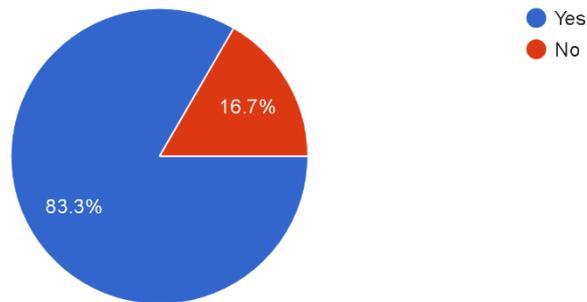
i) Whether TU has its own mechanism in repairing of electrical fault:

60 responses



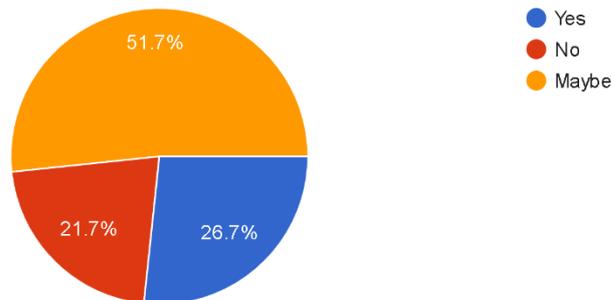
j) Whether the class rooms are with sufficient illumination in day time and ventilation:

60 responses



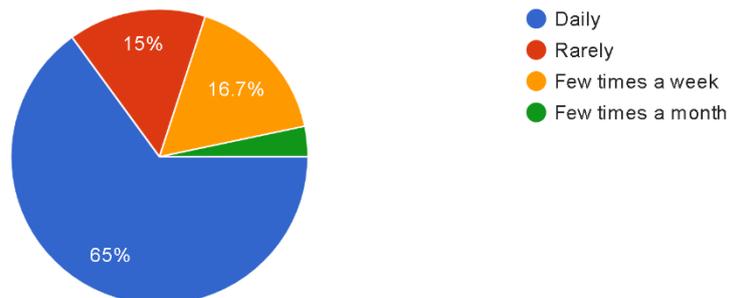
l) Whether TU has organized lectures on energy conservation in order to give awareness to the students:

60 responses



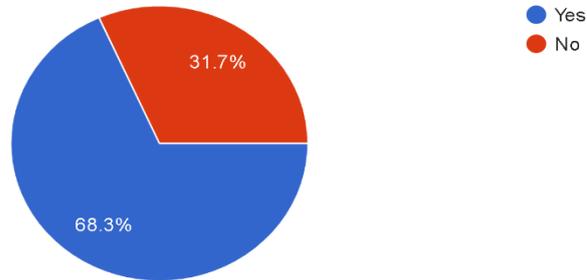
m) How frequently do you use appliances/equipment within the university premises?

60 responses



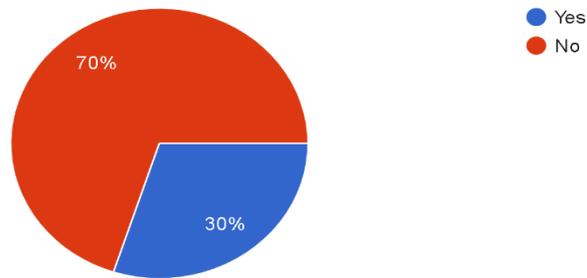
o) Whether the architectural design for TU is based upon use of natural lighting & ventilation, to save extra power for bulbs and fans:

60 responses



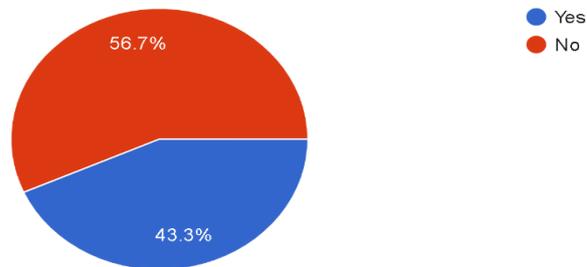
q) Are you aware of any conservation strategies or practices implemented within TU?

60 responses



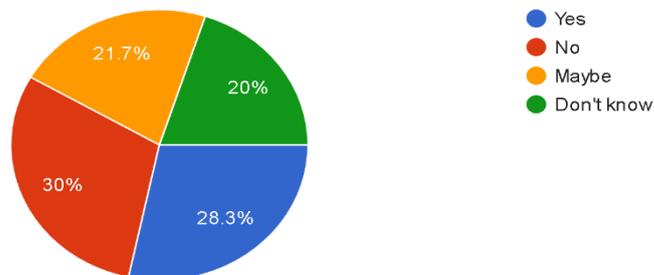
c) Have you observed any waste reduction or recycling initiatives on campus?

60 responses



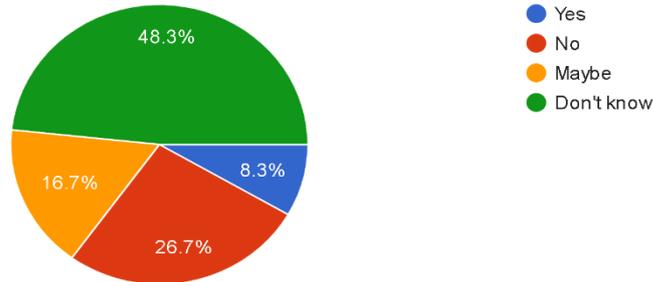
d) Whether TU has arranged any workshop/ seminar/ conference for awareness the students/ staff for specific arrangements for recyclable wastes:

60 responses



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

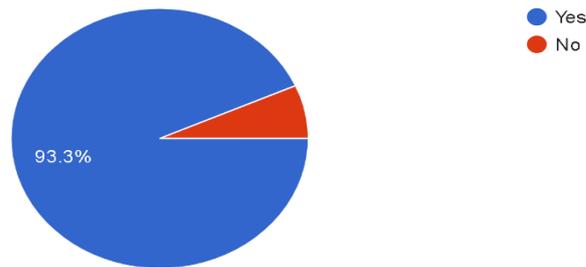
60 responses



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 following set of questions has open opinion based responses which are provided below:

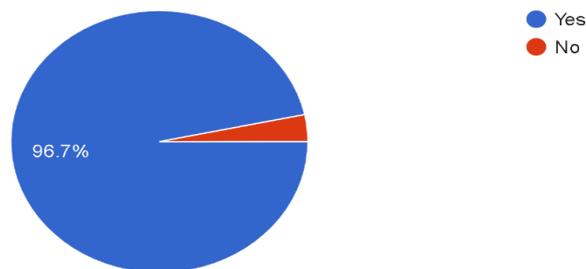
a) Is there garden inside/ outside the campus under TU custody?

60 responses



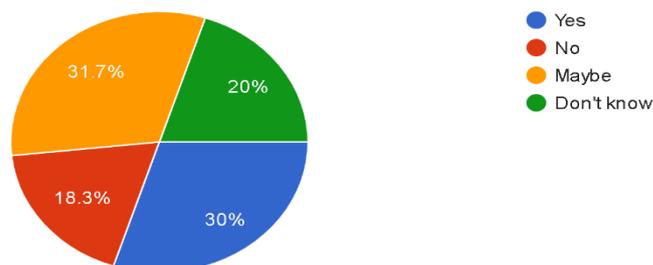
c) Have you come across migratory birds and wild animals in the TU campus?

60 responses



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

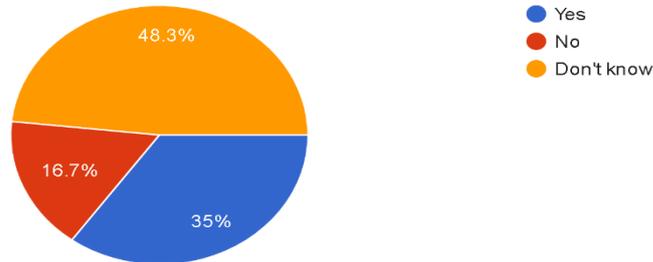
60 responses



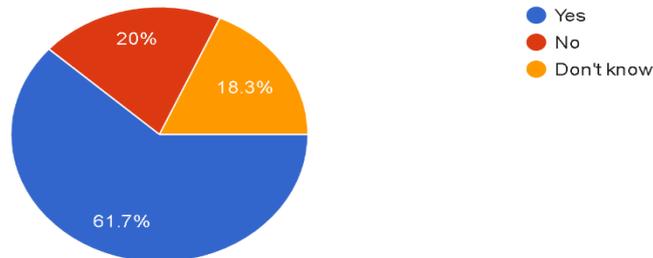
f) If the response to the above question is 'Yes', please provide formation about those efforts: 6 responses

Tree plantation, taking care of the lake so that migratory birds can enjoy their time  
 GOOD  
 Plantation programmes are organised by the eco club which overlooks on green movements  
 Some initiative taken by Forestry and Biodiversity Department  
 There is a botanical garden  
 Forestry Park, pinning scientific name and common name on placards for identification of trees

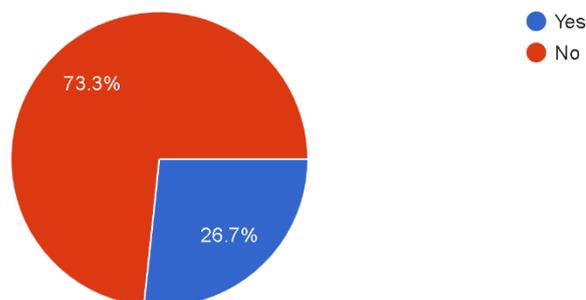
g) Is there any mechanism of review or periodical monitoring of tree species?  
 60 responses



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



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



b) If your response is 'Yes', please briefly describe the strategies or practices: 7

responses

good

Biodiversity management

Campus need to a central park

Use of Eco bricks

Vasudha eco club

Planting more trees

Various practices are performed within the TU campus for conserving and protecting the environment Small small steps are also taken such as making of ecobricks etc.



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