

Report on Green Audit

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15/11/2023
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Report on Green Audit**REPORT OF GREEN CAMPUS AUDIT**

NSF Motto:
'Save the
Nature to
save the
Future'

Submitted to

Kovai Kalāmagal Educational Trust

(Kovai Kalaimagal Arts and Science College)
(Coimbatore Institute of Engineering and Technology)
(Coimbatore Institute of Management and Technology)
(School of Architecture CIET)

Coimbatore- 641 046, Tamil Nadu, India.

Date of Audit 16.12.2021 (Thursday)

Submitted by



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(A Unique Research and Development Center
for Society Improvement)

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1. Introduction

Green campus is an area of the Organisation or the Organisation as a whole itself contributing to have an infrastructure or development that is structured and planned to incur less energy, less water, less or pollution free, less or no CO₂ emission (Aparajita, 1995). Green Campus Audit is a tool of the environment management system which is used methodologically for protection and conservation of environment and sustenance of the ecosystem. Green campus constitutes the environmental friendly practices and education combined to promote sustainable and eco-friendly practices along with user-friendly technology in the campus. It creates environmental culture, develops sustainable solutions to environmental problems and provides solutions to various social and economic needs (APHA, 1981). It provides the concept of Green building and oxygenated building which in turn provides a healthy atmosphere to the stakeholders.

Green Campus Audit ensures the Organization's campus should be greenish with large diversity of trees, herbs, shrubs, climbers and lawns to reduce the environmental pollution and soil erosion, also useful for biodiversity conservation, landscape management, proper water irrigation, natural topography and vegetation (Gowri and Harikrishnan, 2014). The maintenance of an eco-friendly campus ensures a neat and clean environment. For the benefit of stakeholders, solid state management, recycling of water, disposal of sewage and waste materials including electronic and biomedical wastes, plastic use, etc. should be followed consistently in the organization campus.

Green Campus Audit procedures includes the definition of green audit, methodology on how to conduct Green audit at Educational Institutions and Industrial sectors as per the checklist of Environment Management Systems and International Standards on ISO 14001:2015, Indian Green Building Council, Swachh Bharath Scheme under Clean India Mission to understand the principles and importance of various audits in the context of the organization and risk assessment at 360° views (Gnanamangai *et al.*, 2021). It analyses to help the educational institutions and industries to maintain eco-friendly environment and personal hygiene to various stakeholders and supports the nation as a whole for the noble cause of environmental protection and nature conservation which in turn enhances the quality of life to all living beings (Arora, 2017).

2. Role of Educational Institutions in India

Educational institutions are playing important role in a nation's growth and development which starts from maintenance of green campus without harming the environment. A clean and healthy environment in an Organization determine effective learning and provides a conducive learning environment to the students. Educational institutions are asked both Central and State Governments to give eco-friendly atmosphere to the stakeholders. In addition, all the Educational institutions are asked to save the environment for future generations and to solve the environmental problems such as recycling of solid wastes and wastewaters, plastics usage, napkin disposal water consumption, water harvesting and storage mechanisms, etc. through Environmental Education. Implementing Swachh Bharath Abhiyan Scheme launched by the Indian Government plays by the Educational institutions plays a major role in terms of giving

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neat and clean environment to tribal, rural and urban people across the country, besides, the regular and conventional activities carried out by NSS, NCC, Nature club, Eco club, Science club, Fine Arts club, Flora and Fauna club, You Red cross unit, etc. Seminar, Conference, Workshop, training and awareness programmes on Biodiversity conservation education, environmental awareness programmes, etc. may be conducted periodically by the Management and Administrative people of an Organization to the stakeholders.

Green campus auditing is a systematic process whereby an organization's environmental performance is checked against its environmental policies and compliances of the Government guidelines. This audit process is definitely useful for the Educational institutions to maintain the campus neatly and can give pure atmosphere to the students and staff members including Management people. It is like an official examination of the environmental effects on an organization's campus as per the Government guidelines. The audit report may be useful to improve the organization's campus significantly by following the recommendations and suggestions given in the report.

3. Green Campus and Environment Policy

The green campus and environment policy aims to provide an education and awareness in a clean and green environment to the stakeholders with regards to environmental compliance. The scope of this policy applies to all employees and students of the Institution to provide an ecofriendly atmosphere. Policy making dealt with cleanliness on the campus is maintained through proper disposal of wastes and steps taken to recycle the biodegradable wastes. Utilization of eco-friendly supplies and an effective recycling programme to maintain the campus free from hazardous wastes. The concept of eco-friendly culture is disseminated among the students as well as rural community through various awareness programmes, seminars / conferences, reuse and recycle the waste materials. Attempts is made to limit energy usage and also replace non-renewable energy sources with renewable energy sources. The Head of the Organization, Department Heads and Senior Managers including Management Representatives are responsible for monitoring the go green initiatives of the College / University and maintain a clean/green campus. In addition, the staff and student volunteers from Nature club, Eco clubs, Science club, Fine Arts club, Youth Red cross unit, NCC and NSS units are also responsible for the implementation of the green campus and environment policy in the Organization.

4. Environment Friendly Campus

The organization is responsible to provide an eco-friendly atmosphere to the stakeholders along with making good drinking water facility to the students and staff members. The organic manure, cow dung, farmyard manure and vermicompost for the cultivation of plants should be adopted. All non-compostable, single-use disposable plastic items, single-use plastic utensils, plastic straws and stirrers should be avoided. Education on the commitment to plastic-free alternatives for all incoming and current students, staff and faculty should be undertaken. Reduction of use of papers alternated with e-services and e-circulars, etc. and proper disposal of wastes, recycling and suitable waste management system should be taken into consideration.

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5. Aims and Objectives of Green Campus Audit

- To recognise the initiatives taken towards the green campus by means of gardening by the Organization.
- To identify and provide baseline information to assess threat and risk to the ecosystem due to Organization development.
- To recognise and resolve different environmental threats of the Organization.
- To grow a large number of oxygen producing and carbon-di-oxide absorbing plants in the campus to give a pure atmosphere to the stakeholders.
- To ensure proper utilization of resources available in the surrounding areas towards future welfare of the community.
- To set a procedure for disposal of all kinds of wastes and use green cover as a carbon sink for pollution free air.
- To assess the greenish nature of an Organization campus in terms of trees, herbs, shrubs, climbers, twins, lianas, lawns and reflected in reducing the environmental pollution soil erosion, biodiversity conservation, landscape management, natural topography and vegetation.

6. Scope and Goals of Green Auditing

The Management of the Organization (Auditee) should be shown their inherent commitment towards making ecofriendly atmosphere through the green auditing and ready to encourage all types of green activities. They should promote all kinds of green activities such as conduct of environment awareness programmes, campus farming, planting trees, maintenance of greening, irrigation, use of biofertilizers and avoidance of chemical fertilizers and agrochemicals on the campus etc., before and after the green auditing. The management should formulate 'Green and Environment Policies' based on green auditing report. A clean and healthy environment should enhance an effective teaching and learning process and provides a conducive learning environment to the stakeholders. They should create the awareness on the importance of environment through environmental education among the student members. Green Audit is the most efficient and ecological way to manage environmental problems.

Green campus audit may be beneficial to the campus in improving the greenery activities which in turn useful to save the planet for future generation. Green campus audit is a kind of professional care and a simple indigenized system about the environment monitoring in terms of planting a large number of trees which is the responsibility of each and every individual who are the part of economical, financial, social, environmental factors. It is necessary to conduct green audit frequently at least once in three years in campus because students and staff members should aware of the green audit and its advantages to save the planet by means of 'Go green concept' and help the institution to set environmental examples for the community, and thereby to educate the young learners. Green audit is a professional and useful tool for an Organization to determine how and where they are maintaining the campus eco-friendly manner. It can also be used to implement the mitigation measures is a win-win situation for all the stakeholders and the planet. It gives an opportunity for the development of ownership, personal and social responsibility for the stakeholders.

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7. Benefits of the Green Auditing

There are several benefits on conduct of green audit by the Organization which may be definitely useful to improve the campus significantly after receiving the report of audit. The green campus audit contained methodology followed and both qualitative and quantitative measurements including physical observation of greeneries in terms of growing of terrestrial and aquatic plants, animals and microflora in the campus. The natural and planted vegetation and their maintenance are also considered in the organization campus through topography, landscape management design and soil erosion control in environment sustainable development. The following are the major benefits of the green auditing.

- Know the status of development of internal and external Green campus audit procedures and implementation scenario in the Organization.
- Establishment of Green campus objectives and targets as on today as per the 'Green and Environment Policy', 'Indian Biodiversity Act' and 'Wildlife Protection Act' of the Ministry of Environment, Forests and Climate Change, New Delhi and World & Indian Green Building Council concepts.
- Assigning the roles and responsibilities of Environmental Engineer and Agriculture Staff to give to improve green initiatives.
- Development of ownership, personal and social responsibility for the Organization and its environment and developing an environmental ethic and value systems to young generations.
- Enhancement of the Organization profile and reach the global standards in proving the green campus and eco-friendly atmosphere to the stakeholders
- Improving the drinking water / RO water / Bore well water / Open well water / Pond water / Municipal or Corporation water quality through the analysis of Physico-chemical properties of water.
- Creation of wastewater treatment facility and solid waste management provision in the campus for recycling of wastewater and solid wastes to minimize the air, water and soil pollution.
- Suggested of availability of Biogas plant to the management to restrict the usage of fossil fuel in cooking purposes.
- Implementing status of the rain harvesting system, water reservoirs, percolation pond, etc. in the campus to increase the ground water level.
- Establishment of terrace garden, herbal garden, kitchen, zodiac, ornamental gardens, etc. for enhancing teaching and learning and commercial exploitation.
- Treated water consumption towards plant cultivation, canteen, hostel, machinery cleaning, transport, toilet use and etc. on water consumption and per capita water consumption per day calculation.
- Studying the campus flora by making a complete data on total number of both terrestrial and aquatic plants, herbs, shrubs, climbers, twins and grasses.
- Survey of campus fauna by conducting the number living and visiting animals, insects, flies, moths and worms in the campus.
- Documentation of the number of oxygen producing and carbon dioxide absorbing plants planted in the campus to give pure atmosphere to the stakeholders.
- Operation of water irrigation, drip and sprinkler irrigation methods to improve the green campus.

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- Studying the biodiversity conservation through Life Sciences and Biological Sciences people to conserve economically important, rare and endangered plant and animal species in the campus ecosystem.
- Recommendation in use of biofertilizers, organic and green manures, cow dung manures and farmyard manures for the cultivation of plants to protect the environmental health
- Conduct of outreach programmes for dissemination of Green Campus motto and Green pledge initiatives to rural, tribal and urban people through Eco club, Nature club, Science club, Fine Arts club, Youth Red Cross unit, NCC and NSS bodies.
- Academic credentials like major and minor Projects, Dissertations and Thesis work on green campus, environment protection and nature conservation by the students and staff members.
- The plants available in the campus must be tagged with their common name and Botanical name for the stakeholders to impart the knowledge on medicinal and ornamental, economic and food values of plant varieties.
- MoU may be signed with Government and non-Governmental Organizations (NGOs) to utilize the resources for nature conservation and environmental protection.
- Implementation of Government schemes (Swatch Bharath Abhiyan under Clean India Mission) to give pure and safe water to rural people and teach the importance of cleanliness of toilets and restrooms.
- Conduction of awareness programmes and cultural activities on global warming, environmental changes and ecosystem maintenance to the stakeholders.
- Steps taken for organic, inorganic, toxic, e-waste, biomedical, food, sewage waste management, segregation of wastes and reuse methods.
- Public transport, low-emitting vehicles and control of car smokes and exhaust towards carbon accumulation in the campus by carbon footprint studies.
- Implementation of advanced methods for watering plantations (Drip irrigation, Sprinkler irrigation, etc.) and use of metering for water utility, IoT based watering, automation, water device, remote water lines, etc.
- Percentage of Organization's budget for environment sustainability efforts and green campus initiatives planning and efforts.
- Campus facilities for disabled, special needs and or maternity care including security, safety and health infrastructure facilities for stakeholder's wellbeing.
- More efficient resource management, provide basis for improved sustainability and creation of plastic free campus to evolve health consciousness among the stakeholders.
- Impart environmental education through systematic environmental management approach and improving environmental standards by making a benchmark for environmental protection initiatives
- Best practices followed on green campus initiatives in the Organization listed and disseminated among the stakeholders.
- Recommendations for improving the green initiatives, planning and efforts in the campus after audit report to improve further.

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8. About the Organization

Kovai Kalaimagal Educational Trust

The Kovai Kalaimagal Educational Trust established in the year 1992 with an aspiration to quench the educational thirst of the poor and the needy strata of the society particularly from rural area. It sprouted with the establishment of a school and soon extended to add Kovai Kalaimagal College of Arts and Science in the year 1996 – 1997, Coimbatore Institute of Management and Technology in 1996 – 1997, Coimbatore Institute of Engineering and Technology in 2001 – 2002 and School of Architecture CIET in 2013 – 2014. The trust is managed by the dedicated team of trustees Dr. T. Banumathi, Dr. T. Namradha, Dr. K. A. Chinnaraju, Tmt. P. Shanmugadevi, Thiru. S. Subramanian and Thiru. M. Thangavelu who fully devotes their time for the development of the institutions under the trust and it is due to their tireless efforts, the colleges have carved a name for themselves in the academic circle.

Coimbatore Institute of Engineering and Technology

About the College

Coimbatore Institute of Engineering and Technology offers the students with an advantageous atmosphere with state-of-the-art facilities, distinguished mentors, and pleasant educational environment. The institution provides employability and communication skills for the development of students. It provides quality education in an atmosphere of discipline. The focus is on shaping students to become self-disciplined, self-dependent and self-confident individuals. Coimbatore Institute of Engineering and Technology pulls out all the stops to mold the students' career in such a way that they excel in all subtle distinction of life. The College's stand is not only on the mere acquisition of course knowledge and its application but also on all-round personality development of the student and his value system. The infrastructure facilities have also been made to allow detailed learning ambience for the students. The full-fledged eco-friendly offers a quality environment to the students. Towards fulfilling the above objectives, the Kovai Kalaimagal Educational Trust established Coimbatore Institute of Engineering and Technology in the year 2001 following the general policy of the Govt. of Tamil Nadu to give high priority to Technical Education. The campus is spread over a vast area of about 26.5 acres and has 2.25 Lakh sq. ft. of the constructed area which includes classrooms, drawing halls, laboratories, workshops and associated facilities. CIET is located about 25 km from Coimbatore city, the institute has a very picturesque and serene atmosphere surrounded by green hillocks. Courses Offered such as B.E (Civil, CSC, ECE, EEE, Mech and B.Tech., IT) M.E (CSE, ED and CS) and MBA.

Kovai Kalaimagal College of Arts and Science

About the College

Kovai Kalaimagal College of Arts and Science (KKCAS) Narasipuram, Coimbatore is founded by Kovai Kalaimagal Educational Trust, in the year 1996 with a noble mission to educate the students from rural areas. It is a co-educational institution with an eon of 25 golden years. The institution is a concoction of eco-friendly atmosphere and fine edification. Located at the serene and picturesque view of Vaidehi falls, Adiyogi and scenic mountains in Vellimalaipattinam, the college has a tranquil setting to impart the students with holistic education.

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The Trust lays emphasis on the all-round development of the students. The institution primarily focuses on enlightening students from rural areas who have a less prospect of acquiring a proficient learning with nominal fee. Importance is given to creativity, self-confidence, assertiveness, communication skills, leadership qualities and ethical values of the individual. Besides these, the college specially focuses on the development of knowledge, skill and attitude of the students. Separate in-campus hostels are offered for both boys and girls. Students can utilize college buses for their hassle-free conveyance. The organization have offered both UG and PG such as B.Com, (CA and PA) BBA, B.Sc (CS and IT) BCA, B.Sc Maths and B A. PG Courses such as M.Com (IB and CA) M.Sc (CS and IT)

Coimbatore Institute of Management and Technology **About the College**

Coimbatore Institute of Management and Technology (CIMAT) was established in 1996, by Kovai Kalaimagal Educational Trust. The institute is approved by All India Council for Technical Education (AICTE), New Delhi, approved by the Ministry of Human Resource Development (MHRD), New Delhi, affiliated to Bharathiar University, Coimbatore and has been granted autonomy by the University Grants Commission.

It is located at the foothills of Western Ghats and South India's Manchester -Coimbatore sprawling over a land area of about 10 acres, surrounded by green hillocks, we are in close proximity to some of the leading manufacturing hubs in the city, pioneers in manufacturing Mechanical components, Textiles, Automobile and consumer product companies, giving us the added advantage of integrating classroom knowledge with practical experience. We have centres of excellence that offer courses and conduct research on interesting questions facing various sectors of industry. The Institution have offered various courses such as MBA, MCA, M.Phil, and Ph.D

School of Architecture, Coimbatore Institute of Engineering and Technology **About the College**

School of Architecture – CIET Coimbatore, Tamilnadu, India was established in the year 2013 by the Kovai Kalaimagal Educational Trust (KKET) with the motto of "Light the Light Within." Emphasis is placed on the holistic development of the students coupled with value based education through sound ethics.

- Though we nurture and are working towards a futuristic vision, we strongly believe in sustained growth and progress. Presently the college offers Bachelors of Architecture (B.Arch) five year full-time under graduate degree programme.
- The college is an example of cultural unity with students drawn from most of the districts in the state and the neighboring states. The teaching learning Process is highly innovative with presentations and interactions for curriculum enhancement.
- School of Architecture-CIET is affiliated to Anna University, Chennai and approved by Council of Architecture, New Delhi.

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1. The serene and resplendent mountainous locality of heartwarming atmosphere is an additional boon as it improves the conduciveness for the academic pursuit of the students. B. Arch.

8.1. Kovai Kalaimagal Educational Campus Area details

S.No.	Details of Area	Total area (Sq.m)
1.	Total campus area	218239.90
2.	Built up area	26083.56
3.	Covered Car parking area	450.00
4.	Air-Conditioned Area	2105.00
5.	Non Air-Conditioned Area	23978.56
6.	Gross Floor Area	23450.00
7.	Public Area	4350.00
8.	Service Area	5203.00
9.	Forest Vegetation	24290.00
10.	Planted Vegetation	115139.55

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8.2. Kovai Kalaimagal Educational Institution Campus Bird's eye view



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9. Audit Details

Date / Day of Audit	: 16.12.2021 (Thursday)
Venue of Audit	: Kovai Kalaimagal Educational Trust Coimbatore - 641 109, Tamil Nadu, India.
Audited by	: Nature Science Foundation, Coimbatore - 641 004, Tamil Nadu, India.
Audit type	: Green Campus Audit
Name of ISO EMS Auditor	: Mrs. S. Rajalakshmi , Chairman, ISO QMS & EMS Auditor, NSF.
Name of Lead Auditor	: Dr. R. Mary Josephine , Board of Directors & Botanist, NSF.
Name of Subject Expert	: Dr. D. VinothKumar , Joint Director & Biotechnologist, NSF.
Name of Subject Expert	: Dr. B. Anirudhan Principal, Nehru Arts and Science College, Coimbatore.
Name of IGBC AP Auditor	: Dr. B. Mythili Gnanamangai , IGBC AP, Indian Green Building Council.
Name of ASSOCHAMA Auditor	: Er. Ashutosh Kumar Associated Chambers of Commerce and Industry
Name of Eco & Green Officer	: Ms. S. Sowndharya Eco & Green Council Programme Officer, NSF.



10. Procedures followed in Green Campus Audit

Green campus audit is a structured process of documenting the credentials in terms of number of trees, herbs, shrubs, lawns, climbers and lianas reflected in reducing the environmental pollution and soil erosion and useful for biodiversity conservation, landscape management, natural topography and vegetation. It is a kind of a professional tool for assessing the green campus. Green audit projects the best environmental practices and initiatives taken in the organisation at the prescribed site of audit that brings added value to the organisation in maintaining the eco-friendly campus to the stakeholders. The first step of the audit is ensuring that the organisation has a central role in building the green campus, in order to validate the same (Adeniji, 2008).

Green campus is not intended for the self-sustainability of the building alone, it also involves in propagation of the green campus initiatives so as to be adopted by any individuals and organization at a minimum cost. Green campus audit has been

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conducted as per the checklist of Nature Science Foundation, Coimbatore, Tamil Nadu, India (www.nsfonline.org.in) through the authenticated Professionals for people qualified to investigate and evaluate the campus for validating the best environmental practices. Professional team of ISO Environment Management Audit (14001:2015), Indian Green Building Council Accredited Professionals, Experts of Green campus Lead Auditors and Botanists / Zoologists / Biotechnologists were selected to conduct the Green campus audit process.

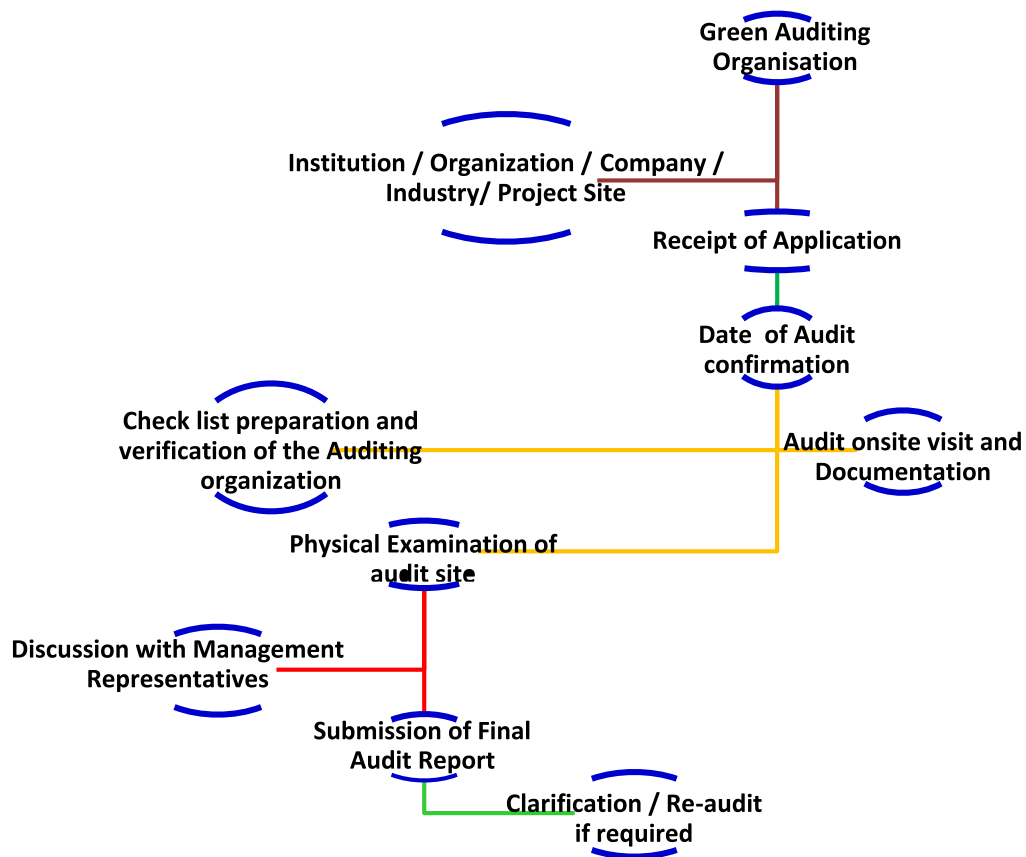
During the audit, the nature of plants and animals / birds species present in the campus were recorded. Establishment of lawns, trees, herbs, shrubs and climbers and establishment of terrace / kitchen / herbal / zodiac / ornamental / medicinal garden / aquarium and aquatic (hydrophytes) plants in the campus were recorded. Labelling of common names and Botanical names of plants were observed. The operation of the water irrigation system, trip and sprinkler irrigation methods and use of recycled water for irrigation purpose or any other purpose in the campus area were noted. The number of water wells, bore wells and water reservoir facilities in the campus were also noted as per the Audit Manual of Gnanamangai *et al.* (2021).

Attempts made for water scarcity during summer season towards the maintenance of plants and frequency of watering for plantations in the campus were noted. Biodiversity conservation education, projects, awareness programmes, etc., through Indian Biodiversity Act and Ministry of Environment, Forests and Climate Change, Government of India and the conduct of outreach programmes for dissemination of Green campus motto were recorded (Venkataraman, 2009). Conduct of outreach programmes for dissemination of Green campus motto to the students and staff members including public domain and signing of MoU with Government and Non-Governmental Organizations to ensure green campus activities for future generation were noted. Technology driven solutions initiated by the Green campus organization can also be disseminated and documented successively for propagating the attitude of the Green campus in wider masses.

Projects, Dissertations and Thesis are the academic effort credentials that always fosters the innovative ideas on thinking and implementation of new innovative approaches towards the green campus. These should be disseminated through presentations and publications in social media, books, magazines and journals so as to spread the innovative ideas and methods to the broad public. These efforts taken by the students and staff were deliberated while conducting the Green campus audit. Green audit processes are taking place as per the following flow-chart starting from the receipt of application forms from the auditee (organization) and ending upon the submission of final report to the concerned organization within 15 days. During the audit process, the best environmental / greenery practices followed and new initiatives undertaken in the organisation to reduce the environmental pollution and steps taken for nature conservation that brings added value to the organisation in maintaining the eco-friendly campus to the stakeholders were assessed (IGBC, 2021; WGBC, 2021). In addition, the role of students and staff members in supporting the vision and mission of the greenery activities of the Organization is also assessed.

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The purpose of the green audit is to ensure that the practices followed in the campus are in accordance with the Green and Environment Policy developed by the Government and private agencies working with environment sustainable development adopted by the institution. The criteria, methods/procedures, checklists and recommendations used in the audit were based on the identified risks. The methodology includes: preparation and filling up of questionnaire along with checklists, physical inspection of the campus, observation and review of the document, interviewing responsible persons and data analysis, measurements and recommendations. The methodology adopted for this audit was a four step process comprising of data collection, data analysis, best practices followed in the campus and recommendations and suggestions given to the organization to improve the greeneries practices further.



Flow-chart of Green Campus Audit Procedures

10.1. Onsite Green Campus Audit activities

1. The opening meeting is the first step between the audit team and auditee. In this meeting, the purpose of the audit, the procedure is to be followed for the conduct

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- of the audit, document verification and the time schedules were discussed in brief along the Management Representatives.
2. Site inspection is the second step for onsite activity. In this step, the Audit team members visited different sites in Kovai Kalaimagal Educational Trust and sufficient photographs were taken then and there for preparing the audit report.
 3. During the onsite phase of visit, it is vivid how the various facilities made by Kovai Kalaimagal Educational Trust Management to the stakeholders without disturbing the landscape, natural topography and vegetation to ensure the green campus.
 4. It is observed how the environment is protected in the campus and by what means an eco-friendly atmosphere is being given to the stakeholders. It is assessed the strengths and weaknesses of the Auditee's Management controls and risks associated with their failure in Green campus facilities were recorded.
 5. Gathering audit evidence *ie*, collecting data and information from the auditee as per the audit protocol were carried out.
 6. An exit meeting was conducted to explain the findings of the audit with the Management Representatives and staff members along with the audit team in brief.

10.2. Pre-Audit stageactivities

A pre-audit meeting (opening meeting) is conducted with Management and Administrative people along with staff coordinators of Energy and Environment audit process, wherein, audit protocol and audit plan were discussed in brief. The purpose of this meeting is to provide an opportunity to reinforce the scope and objectives of the audit and discussions held on the practicalities associated with the audit. Pre-audit stage activities are an important prerequisite for the green audit to meet the auditee and to gather information about the campus and necessary documents were collected directly from the Organization before the initiation of the audit processes. Audit team was selected by the Nature Science Foundation as per the checklist comprised of Lead Auditor of ISO (EMS 14001:2015), Botanist, Agriculture and Horticulture Scientists from Conventional and Technical Universities across India, Accredited Professionals from Indian Green Building Council, Hyderabad and Associated Chambers of Commerce and Industry of India, New Delhi.

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Meeting with the Principal and IQAC coordinator of Kovai Kalaimagal Educational Trust with the Audit Team of the Nature Science Foundation

**Energy and Environment Audit Activity at
Kovai Kalaimagal Educational Trust by NSF Audit Team**



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10.3. Target Areas of Green Auditing

Green campus audit is nothing but a professional tool to assess the greenery activities in the educational institutions and give a value addition to the campus and considered as a resource management process. Eco-campus concept mainly focuses on the efficient use of energy and water; minimize waste generation or pollution and also economic efficiency. Green campus audit process may be undertaken at frequent intervals and their results can illustrate improvement or change over time. Eco-campus focuses on the reduction of carbon emissions, water consumption, wastes to landfill and enhance energy use conservation to integrate environmental considerations into all contracts and services considered to have significant environmental impacts.

There are several target listed in the Green audit process in which a few are taken into consideration as per the Indian scenario is concerned. They are water use efficiency, energy use efficiency, solid, e-waste biomedical, food, sewage waste management and reuse methods, planting of oxygen producing and carbon dioxide absorbing plants, landscape management, topology, vegetation, soil erosion control, carbon footprint due to use of vehicles, electricity and fossil fuels. drinking water quality supply, Biogas plant, rain harvesting system, water reservoirs, percolation pond, establishment of various herbal, terrace and ornamental, gardens, campus and flora fauna, water irrigation, implementation of Government schemes, conduction of awareness programmes management, public transport, low-emitting vehicles and control of car smokes and exhaust, Organization's budget for greenery activities, campus facilities for disabled, special needs and or maternity care, security, safety and health infrastructure facilities for stakeholder's wellbeing.

10.4. Study area of Flora and Faunal diversity

Kovai Kalaimagal Educational Trust Campus is situated on the lowest slope of Southern Western Ghats that is seen as hillock. It is located about 25 km from Coimbatore city and the landmark near Esa Yoga centre in the west side of the Institutions. With a campus of over 26.5 acres, Kovai Kalaimagal Educational Trust is considered as one of the Green Educational Institution in Coimbatore with a rich flora and faunal diversity. It is situated in picturesque surroundings adjacent to the Vellingiri hills, with green hills strewn around. The campus now quite clean, green and has much less pollution to the rest of the city. The KKET campus is important not only from education point of view but also as green lung. It is frequently visited by several nature enthusiasts to study the floral and faunal aspects. Biodiversity provides a useful measure of the quality of the environment and the ecological studies are important aspects of environment, in view of the consideration of environmental quality and protection of natural flora and fauna.

10.4.1. Topography

KKET consists of an environment of moist dry deciduous type of forest at an altitude of 434.32 m mean sea level, 72°58' E of longitude and 11°6' N latitude. It located at the near Vellingiri hills of southern Western Ghats. The Shiva temple of Vellingiri in the western boundary is considered to be the most famous temple is situated up on a scenic hill that is part of the beautiful green Western Ghats.

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10.4.2. Geology and Soil condition

Out of 34 hotspots in the world, Western Ghats is one of the hotspots in Southern India in which Vellingiri hills are located. The area has a predominant black and red soil impregnated with good organic matter, water holding capacity and granite, bed rock is overlaid with shallow, sandy loam and glacial soils are moderate to well drained.

10.4.3. Climatic conditions

Temperature begins increasing after March. April is the hottest month with near daily maximum temperature of 38.2°C and maximum of 25-26°C. The maximum and minimum temperature may go up to 37°C and 16°C; respectively. The average rainfall received in the Coimbatore district is 670 – 699 mm for the past 20 years. Due to the presence of the mountain pass major parts of the district from the south west monsoon in the months from June to August. The rainfall of the south west monsoon is irregular as the masses of clouds are intercepted only very little rain in September. After a warm, humid September, the regular monsoon starts from October lasting till early November. In October north east monsoon sets in heaviest rains are usually or the end of October and throughout November. Out of the total rainfall 25% is received during south west monsoon 49% during October and November and remaining 21% during September.

Annual rainfall is about 60-70 cm, although this rainfall is not enough to sustain the city for the entire year, small rivers like the Siruvani and Atthikadavu fulfill the city’s water needs. The Siruvani river is well known for having water of the purest taste. This is because of large number of Amla (*Embllica officinalis*) trees present in the mountains where the Siruvani river originates which making the greatest assets of Coimbatore city.

11. Identification of Plant Species Kovai Kalaimagal Educational Trust Campus

11.1. Identification of Flowering Plant Species

Various vascular plant species were collected across Kovai Kalaimagal Educational Trust campus and subjected to identify them based on botanical name, family, habitat, uses and anthropogenic disturbances to the natural vegetation in campus. The plants were freshly collected and their digital photographs were also taken. The collected plant specimens have been identified using taxonomic literatures (Gamble and Fischer, 1915-1936; Matthew, 1983; Nair and Henry, 1983; Henry *et al*, 1989; Chandrabose and Nair, 1988). Further, their identification was confirmed by matching with authentic specimens in the Madras Herbarium (MH), Botanical Survey of India, Southern Circle, Coimbatore, India.

11.1.1. Key to Plant Families Identification

- 1a. Seeds enclosed in fruit wall, Perianth Present.....2
- b. Seeds not enclosed in fruit wall, perianth absent.....Gymnosperm
- 2a. Leaves usually net veined seeds-2.....3
- b. Leaves parallel veined, seeds-1.....66
- 3a. Petals free.....4
- b. petals connate41
- 4a. Corolla and calyx present.....5
- b. Corolla and calyx absent.....24

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5a. calyx of united sepals; ovary inferior	31
b. Calyx of distinct or unit sepals; ovary syncarpous.....	6
6a. Sepals imbricate in bud	7
b. Sepals valvate in bud.....	24
7a. Sepals more or less united at the base.....	19
b. Sepals free	8
8a. Stamens more than 12	9
b. Stamens 10 or fewer	13
9a. Sepals 2-3.....	11
b. Sepals 4 or more.....	10
10a. Stamens inserted on the disk.....	Cleomaceae
b. Stamens inserted of the gynophore	Capparaceae
11a. Trees, Petals more or like the sepals; carpels free	Mangnoliaceae
b. Herbs, petals coloured unlike the sepals; carpels united.....	12
12a. Plants with yellow sap, Flowers pedicelled	Papaveraceae
B. Plants with watery sap, Flowers sessile.....	Portulacaceae
13a. Flowers unisexual, gynoecium apocarpus.....	Menispermaceae
b. Flowers bisexual, gynoecium Syncarpous.....	14
14a. Petals 4, Stamens 6	Brassicaceae
b. Petals 5, Stamens ∞.....	15
15a. Ovary 1, loculated	16
b. Ovary 2-more loculated.....	17
16a. Flowers actinomorphic, placentas free- central	Caryophyllaceae
b. Flowers zygomorphic, placentas parietal	Viloeaceae
17a. Filaments of anthers more or less united	Polygalaceae
b. Filaments of anthers more or less united	18
18a. Leaves stipulate; stamens 5 or 10	19
b. Leaves exstipulate; stamens usually 8	Sapindaceae
19a. Style 5; stamen 5	Oxalidaceae
b. Style many; stamens 10	Zygophyllaceae
20a. Leaves pellucid-gland dotted	Rutaceae
b. Leaves not gland dotted	21
21a. Placentas parietal; Fruit elongated	Moringaceae
b. Placentas axile; Fruits not elongated	22
22a. Ovules and seeds pendulous; sometimes horizontal.....	Meliaceae
b. Ovules and seeds erect or ascending	23
23a. Stamens alternate with the petals.....	Anacardiaceae
b. Stamens opposite the petals	Vitaceae
24a. Leaves simple; Flowers 3-merous.....	Annonaceae
b. Leaves compound; Flowers 4-6 merous	25
25a. Filaments of anther united into a columnar toothed cup.....	26
b. Filaments of anther free; rarely connate at the base in ring	28
26a. Stamens 15; anther united	Sterculiaceae
b. Stamens 2; anther free.....	27
27a. Anther unilocular; pollen muricate	Malvaceae
b. Anther bilocular; pollen smooth	Bombacaceae
28a. Stamens 4-5; usually embraced and adnate to the base of the petal.....	29

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b. Stamen many; atleast twice as many as and free from the petals	30
29a. Shrub	Lythraceae
b. Straggler	Rhamnaceae
30a. Anther dehisce by slits; fruits capsule	Tiliaceae
b. Anther dehisce by spores; fruits drupe	Elaeocarpaceae
31a. Ovary syncarpous; placentas 3-5, parietal.....	32
b. Ovary 1 or more free, placentas basal.....	33
32a. Climbing herbs tendril.....	Passifloraceae
b. Erect shrubs or trees with tendril.....	Turneraceae
33a. Ovules arising from the inner angles or from base of the carpels or loculi.....	34
b. Ovules pendulous form the apex of the carpels or locules.....	Combretaceae
34a. Carpels solitary; fruits legume.....	35
b. Carpels more than 1; fruits otherwise.....	37
35a. Flowers zygomorphic; petals imbricate.....	36
b. Flowers actinomorphic; petals valvate.....	Mimosaceae
36a. Upper petals outermost stamens monodelphous or diadelphous.....	Fabaceae
b. Upper petals innermost stamens always free	Caesalpiaceae
37a. Flowers unisexual.....	Cucurbitaceae
b. Flowers bisexual.....	38
38a. Ovary 1-celled.....	Cactaceae
b. Ovary more than 1 celled.....	39
39a. Carpels free if ultimately united the styles distinct.....	40
b. Carpels and styles united throughout.....	Myrtaceae
40a. Flowers in dichasial – polychasial cyme.....	Molluginaceae
b. Flowers in clustered, cymes or solitary.....	Aizoaceae
41a. Ovary inferior, stamens as many as the corolla lobes.....	42
b. Ovary superior, stamens numerous.....	43
42a. Anther free; ovary 2-loculed; stipulate.....	Rubiaceae
b. Anther syngenesious; ovary 1-loculed, exstipulate.....	Asteraceae
43a. Ovary 1-loculed; placentation free central.....	Plumbaginaceae
b. Ovary 2-many loculed; placentation axile or parietal.....	44
44a. Ovary 3 or more carpelled.....	Sapotaceae
b. Ovary 2-carpelled.....	45
45a. Corolla actinomorphic.....	46
b. Corolla zygomorphic.....	50
46a. Plants leafless; parasitic.....	Cuscutaceae
b. Plants leafy ; not parasitic	47
47a. Leaves opposite; stamens 2.....	48
b. Leaves alternate; stamens 4 or more	49
48a. Leaves not scabrid, corolla tube white: fruits berry	Oleaceae
b. Leaves scabrid; corolla tube orange; fruits capsules	Nyctanthaceae
49.a. Anther inseperatable; corona present	Asclepiadiaceae
b. Anther seperatable; corona absent	Apocyanaceae
50a. Corolla lobes imbricate ;fruit drupe	Boraginaceae
b. Corolla lobes plicate; fruit capsule	Convolvulaceae
51.a Ovary cells many ovulated	Solanaceae
b. Ovary cells 1-4 ovuled.....	52

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52.a Carpels 2 or more ovulated ; fruits dehiscent53
 b. Carpels 1 –ovulated ; fruits indehiscent57
 53.a Fruits dehiscent; seeds supported on reticulae.....Acanthaceae
 b. Fruits indehiscent; seeds not supported on reticulae.....54
 54.a Leaves compound; fruits elongated; seeds wingedBignoniaceae
 b. Leaves simple;fruits not elongated, seeds not winged.....55
 55.a Ovules many on swollen placentas; seeds albuminous.....Scropulariaceae
 b. Ovules 2 lobed placenta ; seeds not albuminous.....56
 56.a Flowers solitary; axile placentationPedaliaceae
 b. Flowers raceme; axile placentation.....Martyiniaceae
 57.a Ovary entire, style terminalVerbinaceae
 b. Ovary 4 –lobed, style gynobasic.....Lamiaceae
 58.a Flower bisexual59
 b. Flower unisexual62
 59.a. Ovary inferior60
 b. Ovary superior61
 60.a Ovary 4-6 loculated; ovules manyAristolochiaceae
 b. Ovary 1-loculated; ovules 1-4Santalaceae
 61.a Perianth not tubular Amarathaceae
 b. Perianth trubularNyctaginaceae
 62a. Leafless trees; brachlets ribbed and joined at the nodes.....Casuarinaceae
 b. Leaves well developed ; brachlets not ribbed and not joined at the nodes.....63
 63 a. Ovary 1- loculed; ovules 1-2 in each loule.....64
 b. Ovary 2 or more loculed;ovules 1 or 2 in each locule.....65
 64a. Leaves glandular.....Euphorbiaceae
 b. Leaves e glandular.....Urticaceae
 65a. Filaments inflexed in bud with reversed anther.....Moraceae
 b. Filaments not inflexed in bud, not with reversed anther.....Ulmaceae
 66a. Terrestrial or epiphytic.....67
 b. Aquatic, marsh or riparian.....Cyperaceae
 67a. Arbrosescent woody; leaf blade many nerved articulate with sheath...Bambusaceae
 b. Herbs with herbaceous culms; leaf blade sessile not articulate with sheath.....68
 68a. Perianth 0 or reduced to scale.....Araceae
 b. Perianth present.....69
 70a. Plant armed.....71
 b. Plant unarmed.....72
 71a. Plants Xerophytic; leaves fibrous.....Agavaceae
 b. Plants not xerophytic; leaves nor fibrous.....Lilliaceae
 72 a. Perianth segments connate.....Amaryllidaceae
 b. Perianth segments free.....73
 73a. Outer perianth calycine; inner coroline.....Commelinaceae
 b. Outer and inner perianth

11.2. Identification of Non-Flowering Plant Species

11.2.1. Lichen Identification

The lichen specimens were collected from Kovai Kalaimagal Educational Trust campus and then identified based on the lichen identification key of Awasthi (2007).

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The representative lichen were identified based on the morphological features of thalli such as rhizine, cilia and pseudocephellae and reproductive structures (fruiting bodies) such as apothecia, perithecia, soredia, soralia, conidia and isidia embedding on the thalli surface using a stereo microscope (CZM4, Labomed, India). The anatomy of thallus used in the present study characterized the features of micro morphological analysis such as medulla thickness, upper and lower surface of thallus, lobes, size and shape of spores. Thin section of apothecia and perithecia was made to observe the nature ascus spores and the arrangement of the algal and fungal layers in the thallus; respectively. Over 700 secondary metabolites are known to produce from lichen species which were identified based on Thin Layer Chromatography (TLC) techniques. Spot tests featured the use of chemical reagents to detect lichen substances by appearances of the characterized colour changes on lichen thallus was noted. The lichen chemistry was analyzed according to Culberson and Kristinson (1970) methods. The colour spot test was done on medulla of lichen thallus using test reagents of potassium hydroxide (K), calcium hypochlorite (C) and paraphenylene di amine (PD). Lichen was identified based on colour spot test using the procedure described by Orange *et al.* (2001).

To authenticate the identified lichen samples, the representative samples were compared with the voucher specimens at the lichen herbarium centre of National Botanical Research Institute (NBRI), Lucknow, Uttar Pradesh, India and Department of Botany, Bharathiar University, Coimbatore, Tamil Nadu. The lichen species might be confused with other species unless their morphological, biochemical and anatomical features were closely monitored. Therefore, apart from microscopic observation, spot tests, chemical profiling and TLC tests, attempts were made to compare the representative samples with voucher specimens.

11.2.2. Key to identify the Lichen Genera

Key to Genera

- 1 a. Photobiont cyanobacterium *Leptogium cyanascens*.
- 1 b. Photobiont green alga 2
- 2. Thallus leprose, crustose..... Group I
- 3. Thallus foliose..... Group II
- 4. Thallus fruticose..... Group III

Group I

- 1 a. Thallus leprose,..... *Chrysothrix chlorina*
- 1 b. Thallus crustose..... *Graphis*

Group II

- 1 a. Lower side of thallus pseudocyphellae, photobiont Nostoc *Pseudocyphellaria*
- 1 b. Thallus lacking pseudocyphellae 2
- 2 a. Upper cortex thick walled longitudinally oriented, conglutinate hyphae..... 3
- 2 b. Upper cortex otherwise..... 4
- 3 a. Thallus lower side canaliculated zeorin, norstictic and salazinic acids, and unknown pigments and triterpenoids present..... *Heterodermia leucomelos*
- 3 b. Thallus lower side no canaliculated only in medulla..... *Heterodermia diademata*
- 4 a. Cilia bulbate at the base, thallus grey to grey brown *Bulbothrix*
- 4 b. Cilia present or absent, not bulbate..... 5
- 5 a. Rhizines dichotomously branched present throughout the margins.... *Hypotrachyna*

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5 b. Rhizines restricted to center of lower surface, margin bare, smooth shining.....6
 6 a. Lobes narrow, long, dichotomously branched, canaliculate.....*Everniastrum*
 6 b. Lobes otherwise.....7
 7 a. Lobe margins ciliate.....8
 7 b. Lobe margins eciliate.....9
 8 a. Salazinic acid present K+ Red cortex.....10
 8 b. Salazinic acid absent11
 9 a. Thallus with isidia.....*Parmotrema tinctorum*
 9 b Thallus with soredia.....12
 10 a. thallus emaculate.....*P.stuppeum*
 10 b. thallus maculate.....*P.reticulatum*
 11 a. Protolichesternic acid in medulla*P.grayanam*
 11 b. Alectoronic acid in medulla.....*P. nilgherrense*
 12 a. Thallus large lobed, loosely attached, mainly corticolous*P. austrosinense*
 12 b. Thallus smaller, closely to strongly attached, saxicolous.....*P.defectum*

Group III

1 a. Squamules in thallus.....*Cladonia* sp
 1 b. Squamules absent in thallus2
 2 a. Thallus flat, strap shaped or palmately lobed.....*Ramalina*
 2 b. Thallus round to angular in section3
 3 a. Thallus bright yellow to orange, K+ purple... ..*Teloschistes*
 3 b. Thallus greenish grey or yellowish grey pendent or erect.....4
 4 a. Medulla K+ red Stictic acid present*Usnea stigmatoides*
 4 b. Medulla K- norstictic psoromic acid present.....*Usnea dasaea*

11.2.3. Identificayion oAlgaeGenera

Algae are the members of a group of predominantly aquatic photosynthetic organisms of the kingdom *Protista* followed by terrestrial algae found in freshwater and slump areas. They are non-flowering and lower group of plants which are green in colour because of presence of chlorophyll pigments in the body called thallus. Algae have many types of life cycles, and they range in size from microscopic *Micromonasto* species to giant kelps that reach 60 metres (200 feet) in length. Their photosynthetic pigments are more varied than those of plants, and their cells have features not found among plants and animals. In addition to their ecological roles as oxygen producers and as the food base for almost all aquatic life, algae are economically important as a source of crude oil and as sources of food and a number of pharmaceutical and industrial products for humans. Algae are defined as eukaryotic (nucleus-bearing) organisms that photosynthesize but lack the specialized multicellular reproductive structures of plants, which always contain fertile gamete-producing cells surrounded by sterile cells. Algae also lack true roots, stems, and leaves features they share with the avascular lower plants (e.g., mosses, liverworts, and hornworts).

Algae identification key consists of couplets of characteristics using algal description of the specimen based on morphological characterization from 58 Genera to species level identification as per the comprehensive key.

1A. Plant pigments contained in chromatophores or chloroplasts -----10

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IB. Plant pigments not contained, but diffused through protoplast -----2
 2A. Plants filamentous; cells arranged in trichomes ----- 4
 2B. Plants colonial, not filamentous ----- 3
 3A. Cells in regular rows, in multiples of four; -----*Agmenellum*
 3B. Cells somewhat evenly arranged toward periphery of spherical colony; barely visible gelatinous strands radiate from center of colony to cells ----- *Gomphosphaeria*
 3C. Colony asymmetrical; cells very dense and unevenly distributed -----*Anacystis*
 4A. Filaments straight or slightly flexed ----- 6
 4B. Filaments curved, twisted, or spiralled -----5
 5A. Heterocysts and akinetes present -----*Anabaena*
 5B. Heterocysts absent -----*Raphidiopsis*
 6A. Heterocysts present -----9
 6B. Heterocysts absent -----7
 7A. Filaments without a sheath; cells discoid -----
Oscillatoria
 7B. Filaments with distinct sheath -----8
 8A. Trichomes tangled; sheaths confluent -----*Phormidiwn*
 8B. Trichomes separate; sheaths not confluent -----*Lyngbya*
 9A. Heterocysts terminal -----*Cylindrospermum*
 9B. Heterocysts intercalary -----*Ahphanizomenon*
 10A. Cell walls without punctae or striae -----31
 10B. Cell walls rigid, ornamented with punctae or striae ----- 11
 11A. Frustules adiametric, two or more times longer than wide, elongate -----15
 11B. Frustules isodiametric, generally shorter in length than in diameter, round or elliptical or ovoid or nearly so ----- 12
 12A. Frustules elliptical or ovoid or nearly so -----14
 12B. Frustules discoid or nearly so -----13
 13A. Valves radially punctate -----*Stephanodiscus*
 13B. Valves with two concentric regions, the inner being smooth -----*Cydotella*
 14A. Frustules with marginal keel containing a raphe -----*Surirella*
 14B. Frustules with a pseudoraphe or with a raphe not in a marginal keel ---*Cocconeis*
 15A. Frustules cylindrical arranged end to end into filament -----*Melosira*
 15B. Frustules not arranged into filaments -----16
 16A. Frustules with a raphe in at least one valve -----21
 16B. Frustules without a raphe in either valve, pseudoraphe evident -----17
 17A. Frustules united in zigzag chains -----*Tabellaria*
 17B. Frustules not in zigzag chains -----*Pseudoraphe*
 18A. Frustules united laterally -----*Fragilaria*
 18B. Frustules not united laterally -----19
 19A. Frustules united apically forming spokelike colony -----*Asterionella*
 19B. Frustules not forming spokelike colony -----20
 20A. Frustules needle shaped without costae -----*Syredra*
 20B. Frustules with prominent costae -----*Diatom*
 21A. Frustules sigmoid or "S" shaped -----*Gyrosigma*
 21B. Frustules not sigmoid ----- 22
 22A. Frustules longitudinally symmetrical, other than lunate in valve view ----- 25
 22B. Frustules with raphe in both valves, longitudinally asymmetrical, lunate ----- 23

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23A. Valves with transverse costae -----*Epithemia*
 23B. Valves without transverse costae -----24
 24A. Raphe a smooth curve with well defined central and polar nodules ----*Cymbella*
 24B. Raphe not a smooth curve, gibbose with marginal central nodule -----*Amphora*
 25A. Frustules with raphe in both valves -----27
 25B. Frustules with pseudoraphe in one valve and raphe in other valve -----26
 26A. Frustules wedge-shaped in girdle view and cuneate in valve ----*Rhoicosphenia*
 26B. Frustules shaped otherwise -----*Achnanthes*
 27A. Raphe extended length of valve; polar nodules; central nodules lacking -*Eunota*
 27B. Raphe restricted to polar regions -----28
 28A. Raphe located in a canal -----*Nitzschia*
 28B. Raphe not located in a canal -----29
 29A. Frustules with symmetrical valves -----30
 29B. Frustules with valves symmetrical but asymmetrical -----*Gomphonema*
 30A. Valves with transverse costae -----*Pinnularia*
 30B. Valves with transverse punctae -----*Navicula*
 31A. Cells solitary -----45
 31B. Cells colonial or grouped -----32
 32A. Cells enclosed in conical to cylindrical lorica; joined lorica have treelike
 appearance -----*Dinobryon*
 32B. Cells and lorica without treelike appearance -----33
 33A. Colony discoid, one cell in thickness; cells in concentric rings -----*Pediastrum*
 33B. Colony not discoid -----34
 34A. Colonies spherical or globose -----40
 34B. Colonies not spherical -----35
 35A. Colony with elongate cells radiating from common center -----*Actinastrum*
 35B. Colony with cells not radiating from common center -----36
 36A. Colony with four to eight cells positioned in linear series -----*Scenedesmus*
 36B. Colony with cells not in linear series -----37
 37A. Colony with arcuate to lunate cells with apices acutely-----*Selenastrum*
 37B. Colony with spherical to broadly ellipsoidal cells -----38
 38A. Cells without spines or setae -----*Crucigenia*
 38B. Cells with spines or setae -----39
 39A. Cells quadrate, closely apposed; free face of each cell with spines ----*Tetrastrum*
 39B. Cells quadrate and united; free face cell with long delicate setae ---*Micractinium*
 40A. Colony with biflagellated cells -----
Pandorina
 40B. Colony with nonflagellated cells -----41
 41A. Cells lunate to sickle shaped -----*Kirchneriella*
 41B. Cells spherical or nearly so -----42
 42A. Cells borne terminally on dichotomously branched threads ----*Dictyosphaerium*
 42B. Cells not on dichotomously branched threads -----43
 43A. Colony a hollow sphere -----*Coelastrum*
 43B. Colony not a hollow sphere -----44
 44A. Colony surrounded by gelatinized and expanded parent cell wall -----*Oocystis*
 44B. Colony with cells equidistant and toward periphery -----*Sphaerocystis*
 45A. Cells with median constriction dividing cell into two distinct halves -*Cosmarium*

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45B. Cells without pronounced median constriction -----46
 46A. Cells nonflagellated -----53
 46B. Cells flagellated -----47
 47A. Cell walls without polygonal plates -----49
 47B. Cell walls with polygonal plates -----48
 48A. Cells walls of thick plates with distinct sutures -----*Peridinium*
 48B. Cells walls with faintly distinct plates and sutures -----*Glenodinium*
 49A. Cells uniflagellate -----52
 49B. Cells biflagellate -----50
 50A. Cells with two flagella of equal length -----*Chlamydomonas*
 50B. Cells with two flagella of unequal length -----51
 51A. Cells with single chromatophore -----*Chroomonas*
 51B. Cells with 2 large chromatophores -----*Cryptomonas*
 52A. Cells surrounded by distinct lorica -----*Trachelomonas*
 52B. Cells without lorica; fusiform to acicular shaped; posterior end -----*Euglena*
 53A. Cells acicular to fusiform with ends tapering into long spines -----*Schroederia*
 53B. Cells without ends tapering into long spines -----54
 54A. Cells without setae -----56
 54B. Cells with setae -----55
 55A Cells with subpolar or both subpolar and equatorial long setae -----*Chodatella*
 55B Cells with multiple peripheral long delicate setae -----*Golenkinia*
 56A Cells long, slender, and tapered at both ends -----*Ankistrodesmus*
 56B Cells flattened or isodiametric, triangular, quadrangular -----*Tetraedron*

11.2.3. Identification of Major Groups of Mushrooms

1. Mushroom growing on other mushrooms or the decayed remains ----- *Mycotrophs*
2. Growing shelflike on wood (or, if not, then gills *concentric* rather than radial); mushroom *very* tough and leathery, corky, or woody (try tearing it in half); gills tough and hard, sometimes maze-like; cap frequently (but not always) with concentric zones of colour -----*Polypores*
3. Gills running down the stem, not platelike and thus not easily separable from the cap and stem (try removing an entire "gill" with your fingers or a sharp object); mushroom usually *not* growing on wood -----*Chanterelles and Trumpets*
4. Gills not as above; mushroom growing on wood or elsewhere ----*Gilled Mushrooms*
5. Stem absent--or, if present, lateral, Flesh in stem tough----- *Polypores*
6. Cap round in outline; pore surface not running down the stem, or only slightly running down the stem; spore print not white -----
 --*Boletes*
7. Mushroom with spines or "teeth"--either on the underside of a cap, or hanging from a branched structure, or clumped in an indistinct mass -----*Toothed Mushrooms*
8. Mushroom covered in some part with a foul-smelling slime; arising from a soft underground "egg"; variously shaped (like a club or stick, like crab claws, like a lantern, like a Wiffle ball, etc.); frequently found in woods----- *Stinkhorns*
9. Mushroom more or less shaped like a ball, or like a ball raised up on a stem, or like a ball set on a starfish----- *Puffballs*
10. Cap shape convex to centrally depressed or vase-shaped; undersurface, smooth, wrinkled, or gill-like; fruiting embedded -----*Chanterelles*

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11. Cap shape oval, pointed, lobed, saddle-shaped, irregular, or thimble-like (never vase-shaped or convex); undersurface absent, or hard to see or define; many (but definitely not all) species fruiting-----

Trumpets

12. Stem completely hollow, or hollow with cottony fibers inside; cap with pits and ridges, or longitudinally wrinkled, or fairly smooth (never lobed or convoluted); without reddish or reddish brown shades; found in spring----- *Morels & Verpas*

13. Found in summer and fall (or spring in warm coastal areas); cap lobed, saddle-shaped, or irregular and whitish, grayish, brownish, or black; stem surface ribbed or "pocketed" in some species -----*Saddles*

14. Found in summer and fall (or spring in warm coastal areas); cap lobed, saddle-shaped, or irregular and whitish, grayish, brownish, or black -----*Oddballs & Misfits*

12. Identification of Mammals, Birds, Reptiles, Amphibians and Termites

Birds were observed by visual sightings and by calls also the avifaunal data were observed through the Nikon 8 x 40 binoculars and photographs were taken by Canon 600 D camera (55 – 250 mm). The recorded data was noted in the field work note. Later, the birds were identified with the help of field guide- "Birds of Indian subcontinent" by Richard Grimmett, and the IUCN category of the birds were also noted with the same. The point count and transect line methods were used to record the number of bird species in the study area in which regular visits and personal visits were carried out (Ferenc *et al.*, 2014). The surveys were conducted to understand the distribution of bird species in relation to habitats and nesting behavior of birds in the study area. Based on survey richness and abundance of bird species were calculated using Shannon-weaver diversity index. Based on available data and species were selected for nest site selection study. Selected species of birds was analysed for its nest site characteristics between the habitats and also plant species preference was enumerated and assessed. The number of breeding bird species and nests found in different habitats as dependent variables such as biotic and abiotic factors as the independent variable (Jayson and Mathew, 2000).

Reptiles and Amphibians are identified based on colouration, markings on the skin, background colour generally brown, Males often have a flecked pattern on back. Occasionally they are in green, leading to mistaken identification as sand lizard, Males have thicker base to tail and brighter, speckled underside. Newborn young are dark in colour, almost black. A rare species, almost entirely confined to heathland sites in Dorset, Hampshire and Surrey, and sand dunes on the Mersey and Welsh Coast. The most common reptile found in a variety of habitats, including gardens. Spends most of its time underground or in vegetation litter. Most likely to be found underneath objects lying on the ground, or in compost heaps. Snakes are identified based on cream, yellow or white collar behind the head, bordered to the rear by black marks. Body colour ranges from bright green to dark olive, but mostly the latter. Darker specimens can appear black from a distance. Truly black grass snakes are rare. Males are predominately brown, females are grey. Dark butterfly shape on top of head may be noted. Pairs of spots, sometimes fused as bars, running along back with black line running through eye are recorded. Males typically grey with a black zigzag stripe, females generally brown with a dark brown zigzag stripe (Beebe and Griffiths, 2000).

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13. Green Campus Audit Observations

It covers both qualitative and quantitative measurements including physical observation of greeneries in terms of growing of terrestrial and aquatic plants, animals and microflora in natural and planted vegetation and their maintenance. Topography, landscape management design and soil erosion control are playing important role in environment sustainable development in the campus. An account of a large number of Oxygen producing and Carbon-di-oxide absorbing plants planted in the Campus are taken into consideration to give pure atmosphere to the stakeholders. Establishment of different types of gardens in the campus, rainwater harvesting system, operation of water irrigation, drip and sprinkler irrigation methods may be adopted to improve the green campus. Similarly, biodiversity conservation strategies are very essential to conserve a variety of plant and animal species in the campus ecosystem. Biofertilizers, organic and green manures, cow dung manures and farmyard manures may be used for the cultivation of plants which may be protected the environmental health that will not cause any air, water and soil pollution. The various Clubs, Forums, Cells, Associations and Student / Staff Chapters such as Eco club, Nature club, Science club, Fine Arts club, Flora and Fauna club, Youth Red Cross, NCC and NSS bodies may be involved in green campus initiatives, planning and efforts among stakeholders. Outreach programmes may be conducted for dissemination of Green Campus motto and Green pledge initiatives to rural, tribal and urban people. Academic credentials like taking up major and minor Projects, Dissertations and Thesis work by the students and staff members may be taken into account towards green campus initiatives, planning and efforts. Best practices followed on green campus initiatives in the Organization and recommendations for greening are illustrated in the audit report as well.

13.1. Qualitative Measurements

S.No	Requirements and checklists of the audit	Conformity		
		Yes	No	NA
1.	Have internal Green campus audit procedures been developed and implemented in the Organization?	✓		
2.	Have programmes for the achievement of Green campus objectives and targets been established and implemented as on today?	✓		
3.	Whether Green campus audit and Environment audit are simultaneously carried out or separately carried out?	✓		
4.	Whether Indian Biodiversity Act as per the Ministry of Environment, Forests and Climate Change, New Delhi, Wildlife protection act and World & Indian Green Building Council concepts followed?	✓		
5.	Have responsibilities been assigned for programmes at each appropriate function and level? (Environmental Engineer & Agriculture Staff working for environment monitoring)	✓		
6.	Are the following environmental aspects considered in sufficient detail?			
	a. Drinking water / RO water / Borewell water / Open well water / Pond water / Municipal or Corporation		✓	

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	water use and to check quality of water through Physico-chemical properties analysis			
	b. Wastewater treatment facility	✓		
	c. Sufficient number of trees, shrubs, herbs and lawns	✓		
	d. Solid waste management facility	✓		
	e. Availability of Biogas plant		✓	
	f. Rain harvesting system, water reservoirs, etc	✓		
	f. Aquarium and aquatic (hydrophytes) plants	✓		
	g. Establishment of terrace garden, herbal garden, kitchen, zodiac, ornamental gardens, etc.	✓		
	h. Natural Topography or Forest, Planted vegetation	✓		
	i. Water well, Bore well, lake, water reservoir facility	✓		
	j. Water consumption towards plant cultivation, canteen, hostel, machinery cleaning, transport, toilet use	✓		
	k. Treated water consumption towards plant cultivation, machinery cleaning, transport, toilet use and etc.		✓	
	l. Per capita water consumption per day calculated		✓	
7.	Whether plants are tagged properly with their common name and Botanical name for stakeholders?		✓	
8.	Signing of MoU with Govt. and NGOs to disseminate Green campus motto and pledge		✓	
9.	Biodiversity conservation of plants, animals and wildlife, genetic resources (Endangered and endemic species) at each appropriate function and level?	✓		
10.	Are any biofertilizers, organic manures, farmyard manures, vermicompost, green manures and chemical fertilizers used for maintaining plants?	✓		
11.	Establishment of herbal garden, zodiac garden, medicinal garden, kitchen garden, terrace garden and ornamental plants garden in the campus	✓		
12.	Implementation of Government schemes (Swatch Bharath Abhiyan under Clean India Mission)		✓	
13.	Functioning of Nature club, Eco club, Cell, Forum, Association, NCC, NSS bodies and Social Service League for students and staff members on biodiversity conservation, green campus development, etc.	✓		
14.	Conduction of awareness programmes and cultural activities on global warming, environmental changes and ecosystem maintenance to the stakeholders	✓		
15.	Conduction of outreach programmes for dissemination of green campus initiatives, natural resources, environmental pollution and biodiversity conservation to rural, tribal and urban people	✓		
16.	Implementation of composting pits, vermicompost unit, recycling of kitchen wastes collected from Hostels, Canteens, Cafeteria, Food court and other places	✓		

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17.	Maintenance of plantations in the campus and steps taken for water scarcity during summer season to maintain plants	✓		
18.	Steps taken for organic, inorganic, toxic, e-waste, biomedical, food, sewage waste management, segregation of wastes and reuse methods		✓	
19.	Public transport, low-emitting vehicles and control of car smokes and exhaust towards environment monitoring		✓	
20.	Observation on the site preservation, soil erosion control and landscape management	✓		
21.	Projects and Dissertation works and Scholarly publications on environmental science and management carried out by students and staff members	✓		
22.	Implementation of advanced methods for watering plantations (Drip irrigation, Sprinkler irrigation, etc.)	✓		
23.	Use of metering for water utility, IoT based watering, automation, water device, remote water lines, etc.			✓
24.	Percentage of Organization's budget for environment sustainability efforts	✓		
25.	Campus facilities for disabled, special needs and or maternity care including security, safety and health infrastructure facilities for stakeholder's wellbeing	✓		

13.2. Quantitative Measurements

S.No.	Details of Plant and animal species	Numbers
1.	Total number of Flowering plant species inside the Campus	126 species belonging to 76 Genera under 48 families
2.	Total number of Non-Flowering plant species inside the Campus	28 species belonging to Lichens, Pteridophytes, Bryophytes and Mycoflora
3.	Total number of living Mammals inside the Campus	7 species belonging to 4 Genera under 3 families
4.	Total number of visiting Mammals inside the Campus	6 species belonging to 4 Genera under 3 families
5.	Total number of living Birds inside the Campus	12 species belonging Peacock, Crow, Pigeon, Woodpecker, Hen, Sparrows, Myna, Parrot, Pelican Butterfly, Squirrel
6.	Total number of visiting Birds inside the Campus	21 species belonging Owl, Vulture, Eagle, Finch, Swan
7.	Total number of Aquarium	Two each of Natural and percolation Ponds
8.	Total number of Aquatic (hydrophytes) plant species	Seven species belonging to Lotus, Hydrilla, Water

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		<i>Hyacinth, Trapa, Vallisneria Potamogeton, Salvinia</i>
9.	Total number of Grasshoper and Termites	Grasshoper: 12 species Termites: 5 species
10.	Total number of Ambhians and Reptiles	Amphians: 18 species Reptiles: 11 species
11.	Total number of Butterflies and Mosquitos	Butterflies : 43 species Mosquitos: 03 species
12.	Percentage of Forest Vegetation	43.21%
13.	Percentage of Planted Vegetation	0.021%
14.	Percentage of Water consumption to total human population	-
15.	Percentage of Water consumption to total flora and fauna	-
16.	Per capita water consumption per day	-

13.3. Flora and Faunadiversityin Kovai Kalaimagal EducationāTrust Campus

13.3.1. Flora diversity iKovai Kalaimagal EducationāTrust Campus

Ensuring the rich biodiversity in the green campus is an important parameter which reflects the real-time ecosystem. Plants are indicators for assessing the varying levels of environmental quality. In general, plants improve the outdoor air quality with increased oxygen levels and reduced temperature and carbon-di-oxide. The green and varying colour of the flowering plants improve the ambience of the Organization environment. The record on maintenance of the plant biomass and its management are important with respect to green campus initiatives. The existence of such plants and birds in the green campus may be recorded for the rich flora and fauna which are being considered as a value addition to the campus.

The observations indicated that KKET campus has more than 60-65% of wild as well as native plant species and the other 30-35% plant species are ornamental in nature coming under the planted vegetation. The native plant traits promote the indigenous fauna at the site area. Hence, the accountancy of 75% of the wild traits are leveraged for the native animals and birds. The most probable natural vegetation of KKET campus is the dry deciduous type. The remnants of this past vegetation are found in the campus.

The most plants recorded are *Annona squamosa* ~~*Azadirachta indica*~~ A. Juss., *Melia azedarach* L., *Acacia ferruginea* Dc., *Acacia planifrons* Wight & Arn., *Albizia lebbbeck* (L.) Wild., *Dichrostachys cinerea* L.), *Wrightia tinctoria* R. Br, *Morinda coreia* J.E., *Holoptelea integrifolia* (Roxb.), *Ficus benghalensis*, *Wattakaka volubilis* L., *Psudarthira visida* ~~*Ficus religiosa*~~ L., *Borassus flabellife* L., which are dominant trees species characteristic to the vegetation of the campus. Some of the shrub species like *Hibiscus lunarifolius* Wild., *Sida rhombifolia* L., *Crotalaria pallida* Dryand., *Crotalaria retusa* L., *Tephrosia hookeriana* Wight & Arn., *Solanum surattense* Burm., *Barleria buxifolia* L., *Barleria cuspidata* F., *Dodonaea viscosa*, *Bauhinia tomentosa* L., *Anisomeles malabarica* L., *Jatropha gossypifolia* L., *Euphorbia cyanthophora* Murr., *Calotropis gigantea* and *Helicteras isora* are also rather common in the campus.

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The ground flora here is comparatively sparse, but fairly rich in undistributed areas. Some of the common weeds like *Acalypha indica* L., *Achyranthes aspera* L., *Aerva lanata* L., *Priva cordifolia* (L.f.), *Tephrosia purpurea* L., *Tribulus lanuginosus* L., *Veronia cinerea* (L.) Less., *Tridax procumbens* L., *Ageratum conyzoides* L. and *Parthenium hysterophorum* L. are found to be predominant. The species such as *Argemone mexicana* L., *Talinum portulacifolium* (Forsk.) L., *Hibiscus ovalifolius* (Forsk.) L., *Malvastrum coromandelianum* L., *Waltheria indica* L., *Tephrosia purpurea* L., *Turnera ulmifolia* L., *Plumbago zeylanica* L., *Datura metel* L., *Striga densifolia* (Benth.) Benth and *Achyranthes aspera* L. are some common herbs in the campus.

Some of the common climbers found among the shrubs are *Cissampelos pareira* L. var. *hirsuta* L., *Cocculus hirsutus* L., *Cyclea peltata* (Lam.) L., *Tinospora cordifolia* (wild.) L., *Toddalia asiatica* L., *Cissus quadrangularis* L., *Cardiospermum halicacabum* L., *Abrus precatorius* L., *Clitoria ternatea* L., *Macrotyloma uniflorum* (Lam.) L., *Passiflora edulis* Sims, *Passiflora foetida* L., *Citrullus landaus* (Thumb.) L., *Coccinia grandis* L., *Mukia madraspatana* (L.) Jasminum *grandiflorum* L., *Jasminum angustifolium* L., *Jasminum auriculatum* Vahl, *Jasminum cuspidatum* Kottl., *Jasminum trichotomum* Heyne, *Hemidesmus indicus* L., *Pergularia daemia* (Forssk.) and *Tylophora indica* (Burm.f.) L.

This campus is rich in grass species like *Alpuda mutica* L., *Cymbopogon caesius* (Nees ex Hook. & Arn.) L., *Heteropogon contortus* P.Beauv. Ex Roemer & Schultes, *Rottboellia cochinchinensis* (Lour.) L., *Vetiveria zizanioides* L., *Chloris inflata* Link, *Cynodon dactylon* (L.) Pers., *Tragus roxburghii* Panigrahi, *Dactyloctenium aegyptium* (L.) P.Beauv., *Eragrostis aspera* (Jacq.) L., *Eragrostiella bifaria* (Vahl) Bor, Eleusine indica (L.) Gaertner, *Axonopus compressus* (SW.) P.Beauv., *Brachiaria distachya* (L.) Stapf, *Brachiaria reptans* (L.) C. Gardner & C.E. Hubb., *Cenchrus ciliaris* L., *Digitaria bicornis* (Lam.) Roemer & Schultes, *Digitaria ciliaris* (Retz.) Koeler, *Echinochloa colona* (L.) Link, *Melinis repens* (Wild.) L., *Panicum maximum* (Jacq.) L., *Setaria pumila* (Poir.) Roemer & Schultes, *Setaria verticillata* (L.) P.Beauv., along with *Agave Americana* L., *Asparagus racemosus* Wild., *Commelina benghalensis* L., *Cyanotis cristata* (L.) D.Don and *Cyperus rotundus* L.

Most of the species found are common in the campus, some of the species *Cucumis dipsaceus* Ehrenb., *Caralluma bicolor* Ramach., *Hybanthus puberulus* M. Gilbert are rare species. Some endemic grass species like *Andropogon pumilus* Roxb., *Bothriochloa compressa* (Hook.F.) L., *Chloris bournei* Rang & Tadul., *Panicum psilopodium* Trin., and *Perotis indica* (L.) Kuntze are also occurring in the campus. Number of these species decreased and some even face the danger of going extinct due to regular clearing and construction activities. Therefore in terms of preserving the floral biodiversity, it is importance to set up a botanical garden in the confines of the campus and cultivate these plants and protect the ones that grow naturally on the grounds upon the vegetation maintenance.

Invasive species

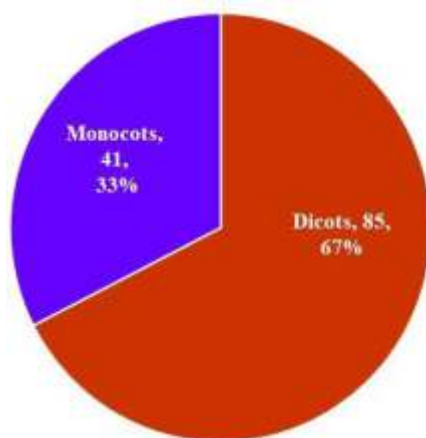
The campus has 21 invasive species such as *Ageratum conyzoides* L., *Alternanthera pungens* (L.) B.K., *Alternanthera sessilis* (L.) R.Br. ex Dc., *Argemone mexicana* L., *Bidens pilosa* L., *Borassus flabellifera* L., *Calotropis gigantea* (L.) R.Br.,

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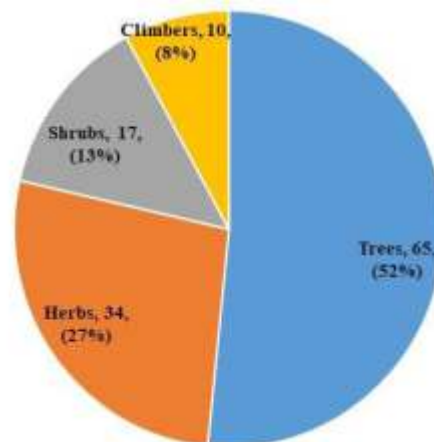
Catharanthus roseus (L.) Don, *Chromolaena odorata* (L.) R. King & H. Robinson, *Cleome viscosa* L., *Corchorus aestuans* L., *Corchorus trilocularis* L., *Crotalaria verrucosa* L., *Croton bonplandianus* Baill., *Cuscuta reflexa* Roxb., *Cyperus difformis* L., *Datura metel* L., *Digera muricata* (L.) C. Martius, *Echinocola colona* (L.) Link., *Euphorbia cyathophora* Murr., *Euphorbia hirta* L., *Evolvulus alsinoides* L., *Ipomea eriocarpa* R. Br., *Lantana camara* L., *Leonotis nepetiifolia* (L.) R. Br., *Malvastrum coromandelianum* (L.) Garcke., *Martynia annua* L., *Melia azedarach* L., *Mirabilis jalapa* L., *Ocimum americanum* L., *Parthenium hysterophorus* L., *Passiflora foetida* L., *Pedaliium murex* L., *Portulaca oleracea* L., *Spermacoce hispida* L., *Stachytarpheta jamaicensis* (L.) Vahl., *Tribulus lanuginosus* L., *Tridax procumbens* L., *Turnera ulmifolia* L., and *Waltheria indica* L. This is clearly indicated disturbances to the natural setting in the vegetated areas.

The alien / exotic species viz, *Annona squamosa*, *Asparagus racemosus* Willd., *Borassus flabellifer* L., *Cassia siamea* Lam., *Casuarina equisetifolia* R & G. Forst., *Delonix regia* (Hook.) Raf., *Eucalyptus tereticornis* Sm., *Holoptelea integrifolia* (Roxb.) Planchon, *Jatropha gossypifolia* L., *Manilkara achras* (Mill.), *Millingtonia horensis* L.F., *Peltophorum pterocarpum* (DC.), *Pithecellobium dulce* (Roxb.) Benth., *Plumeria rubra* L., *Sesbania grandiflora* (L.) Poiret, *Tamarindus indica* L., *Tecoma stans* (L.) Kunth and *Zizyphus mauritiana* Lam. are occur in the campus. The only plantation on the campus is of *Acacia auriculiformis*, *Acacia ferruginea* DC., *Crescentia cujete* L., *Cycas circinalis* L., *Kigelia pinnata* (Jacq.) and *Markhamia platycalyx* (Baker). There are several avenue trees on the campus such as *Bauhinia purpurea* L., *Callistemon cirtus* (Curtis) Skeels., *Cassia fistula* L., *Cassia siamea* Lam., *Casuarina equisetifolia* J.R & G. Frost., *Delonix regia* (Boj. ex Hook.), *Eucalyptus tereticornis* Sm., *Guaiacum officinale* L., *Parkia biglandulosa* Wight & Arn., *Polyalthia longiflora* (Sonn.), *Peltophorum pterocarpum* (DC.) Backer ex K. Heyne., *Pterocarpus marsupium* Roxb., *Samanea saman* (Jacq.) Merr., *Santalum album* L., *Thespesia populanea* (L.) Sol. Ex Corr. Serr. and *Roystonea regia* Kunth.

Some of the species are utilized as fruit yielding like *Annona squamosa*,



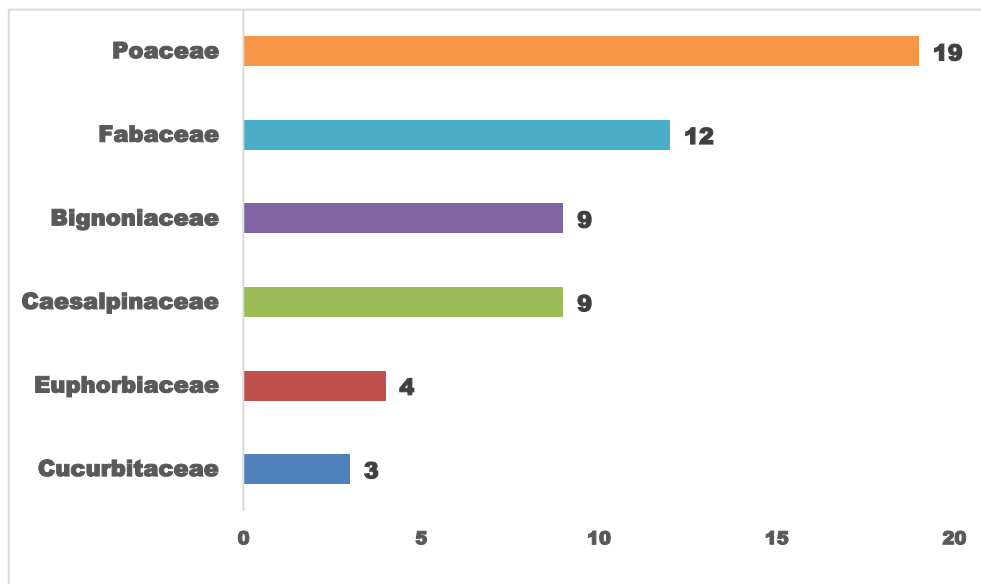
Systematic groups of the plants in KKET campus



Analysis of habit-wise distribution of plant species in the campus area

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(Seetha), *Artocarpus heterophyllus* Lam., (Pala), *Mangifera indica* L. (Maa) Thwaites., *Moringa pterygosperma* Gaertn. (Murungai), *Phyllanthus acidus* (L.) Skeels. (Aranelli), *Phyllanthus emblica* L. (Nelli), *Psidium guajava* L., (Koyya) and *Syzygium cumini* (L.) Skeels. (Naval). Species such as *Cordia sebestena* L., *Jacaranda mimosifolia* D., *Millingtonia hortensis* L.F., *Plumeria alba* L., *Plumeria rubra* L., *Tabebuia rosea* (Bertol.) DC. and *Tecoma stanleyana* (L.) Kunth. are also utilized for their attractive flowers.



Plant families with higher number of species in the campus area

The biodiversity of KKET Campus comprises a total of 126 species belonging to 76 genera under 31 families excluding the lichens, pteridophytes, bryophytes and mycoflora which was not possible during the present study. Of these, Dicots are dominating with 21 families whereas, monocots with 10 families. Over all the Tree were the most dominant flora 65 (52%) followed by Herbs 34 (27%), Shrubs 17 (13%) and Climbers 10 (8%). Among dicots, Polypetalae formed a larger percentage with 9 families, 29 genera and 47 species, Gamopetalae with 5 families, 12 genera and 24 species and Monochlamydeae with 4 families, 10 genera and 14 species. In monocots 13 families are spreading over 25 genera belonging to 41 species. Poaceae is the first dominant family with 19 species followed by Fabaceae with 12 species and Bignoniaceae and Caesalpinaceae with 9 species. During the study in the campus, a total of 10 alien and 24 invasive floral species were recorded. This clearly indicated disturbances to the natural setting in the vegetated sector.

List of Flowering plants in the Kovai Kalaimagal Education Trust campus, India

S.No	Common Name	Botanical Name	Family	Habit
1.	Northern Black Wattle	<i>Acacia auriculiformis</i> L.	Mimosaceae	Tree
2.	Kuteera Gum	<i>Acacia leucophloea</i> Roxb.	Mimosaceae	Tree
3.	Umbrella Thorn	<i>Acacia planifrons</i> Wight	Mimosaceae	Tree

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4.	Custard / Sugar Apple	<i>Annona squamosa</i>	Annonaceae	Tree
5.	Jack Fruit	<i>Artocarpus heterophyllus</i>	Moraceae	Tree
6.	Neem Tree	<i>Azadirachta indica</i>	Meliaceae	Tree
7.	Common Bamboo	<i>Bambusaerundinacea</i> (Retz.) Roxb.	Bambusaceae	Tree
8.	Orchid Tree	<i>Bauhinia purpurea</i>	Caesalpinaceae	Tree
9.	Palmyra Palm	<i>Borassus flabellifera</i>	Arecaceae	Tree
10.	Lemon Bottlebrush	<i>Callistemon citrinus</i>	Myrtaceae	Tree
11.	Golden Shower Tree	<i>Cassia fistula</i>	Caesalpinaceae	Tree
12.	Red Cassia	<i>Cassia roxburghii</i>	Caesalpinaceae	Tree
13.	Siamese Cassia Tree	<i>Cassia siamea</i>	Caesalpinaceae	Tree
14.	Whistling Pine / Casuarina	<i>Casuarina equisetifolia</i>	Casurinaceae	Tree
15.	Coconut Tree	<i>Cocos nucifera</i>	Arecaceae	Tree
16.	Scarlet Cordia	<i>Cordia sebestena</i>	Boraginaceae	Tree
17.	Calabash Tree	<i>Crescentia cujete</i>	Bignoniaceae	Tree
18.	The Queen Sago	<i>Cycas circinalis</i>	Cycadaceae	Tree
19.	North Indian Rosewood	<i>Dalbergia sissoo</i>	Fabaceae	Tree
20.	Flame Tree	<i>Delonix regia</i>	Caesalpinaceae	Tree
21.	Sicklebush / Lantern	<i>Dichrostachys cinerea</i>	Mimosaceae	Tree
22.	Indian Bat Tree	<i>Ficus amplissima</i>	Moraceae	Tree
23.	Indian Banyan	<i>Ficus bengalensis</i>	Moraceae	Tree
24.	Indian Rubber Tree	<i>Ficus elastica</i>	Moraceae	Tree
25.	Hairy Fig	<i>Ficus hispida</i>	Moraceae	Tree
26.	Indian Laurel Tree	<i>Ficus microcarpa</i>	Moraceae	Tree
27.	Sacred Fig	<i>Ficus religiosa</i>	Moraceae	Tree
28.	Fern Tree	<i>Filicium decipiens</i>	Sapindaceae	Tree
29.	Tree of Life	<i>Guaiaecum officinale</i>	Zygophyllaceae	Tree
30.	Jungle Cork Tree / Indian Elm	<i>Holoptelea integrifolia</i> (Roxb.) Pl.	Ulmaceae	Tree
31.	Jacaranda / Fern	<i>Jacaranda mimosifolia</i>	Bignoniaceae	Tree
32.	African Sausage	<i>Kigelia pinnata</i> (Jacq.)	Bignoniaceae	Tree
33.	Mango Tree	<i>Mangifera indica</i>	Anacardiaceae	Tree
34.	Champak	<i>Michelia champaca</i>	Magnoliaceae	Tree
35.	Indian Cork / Jasmine	<i>Millingtonia hortensis</i>	Bignoniaceae	Tree
36.	Indian Mulberry	<i>Morinda coreia</i>	Rubiaceae	Tree
37.	Drumstick Tree	<i>Moringa pterosperma</i>	Moringaceae	Tree
38.	Cork Bush	<i>Mundulea sericea</i>	Fabaceae	Tree
39.	West Indian Cherry	<i>Muntingia calabura</i>	Elaeocarpaceae	Tree
40.	Curry Leaf Tree	<i>Murraya koenigii</i>	Rutaceae	Tree
41.	Night Jasmine	<i>Nyctanthes arboretensis</i>	Nyctanthaceae	Tree
42.	Badminton Ball Tree / African Bean	<i>Parkia biglandulosa</i>	Mimosaceae	Tree
43.	Copperpod / Yellow- Flamboyant	<i>Peltophorum pterocarpum</i>	Caesalpinaceae	Tree

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44.	Malay Gooseberry	<i>Phyllanthus acidu</i> L.	Euphorbiaceae	Tree
45.	Red Frangipani	<i>Plumeria rubra</i> L.	Apocynaceae	Tree
46.	Indian Mast Tree	<i>Polyalthia longifolia</i> L.	Annonaceae	Tree
47.	Indian Beech / Pongame Oil tree	<i>Pongamia pinnat</i> a.	Fabaceae	Tree
48.	Common Guava	<i>Psidium guajav</i> a.	Myrtaceae	Tree
49.	Indian Kino Tree	<i>Pterocarpus marsupi</i> um.	Fabaceae	Tree
50.	Red Sanders / Red Sandalwood	<i>Pterocarpus sandalin</i> us. f.	Fabaceae	Tree
51.	Florida Royal Palm / Royal Palm	<i>Roystonea regia</i> B.K.	Arecaceae	Tree
52.	Rain Tree	<i>Samanea sam</i> aJacq.	Mimosaceae	Tree
53.	Indian Sandalwood	<i>Santalum albun</i> um.	Santalaceae	Tree
54.	Vegetable Huming bird	<i>Sesbania grandiflor</i> a.	Fabaceae	Tree
55.	African Tulip Tree	<i>Spathodea campanul</i> ata	Bignoniaceae	Tree
56.	Java Plum	<i>Syzygium cumi</i> (L.)	Myrtaceae	Tree
57.	Silver Trumpet Tree / Tree of Gold	<i>Tabebuia aurea</i> Benth. & Hook.	Bignoniaceae	Tree
58.	Cuban Pink Trumpet	<i>Tabebuia pallid</i> a(Lindl.)	Bignoniaceae	Tree
59.	Rosy Trumpet Tree	<i>Tabebuia rose</i> a(Berol.)	Bignoniaceae	Tree
60.	Tamarind	<i>Tamarindus indic</i> a.	Caesalpinaceae	Tree
61.	Yellow Stans	<i>Tecoma stan</i> (L.) Kunth.	Bignoniaceae	Tree
62.	Indian Almond	<i>Terminalia catapp</i> a.	Combrataceae	Tree
63.	Dyer's Oleande	<i>Wrightia tinctori</i> aL	Apocynaceae	Tree
64.	Indian Jujube	<i>Ziziphus mauritian</i> a.am.	Rhamanaceae	Tree
65.	Jackal Jujube	<i>Ziziphus oenopl</i> a.	Rhamanaceae	Tree
66.	Indian Acalypha	<i>Acalypha indic</i> a.	Euphorbiaceae	Herb
67.	Prikly Chaff Flower	<i>Achyranthes asper</i> a.	Amaranthaceae	Herb
68.	Running Grass	<i>Brachiaria reptan</i> sL.	Poaceae	Herb
69.	Candelabra Wattle	<i>Brachiaria semiundulat</i> a.	Poaceae	Herb
70.	Running Grass	<i>Brachiaria emiverticillat</i> a	Poaceae	Herb
71.	Cockscomb	<i>Celosia cristat</i> a.	Amaranthaceae	Herb
72.	Indian Sandbur	<i>Cenchrus bifloru</i> sRoxb.	Poaceae	Herb
73.	Buffel Grass	<i>Cenchrus ciliar</i> sL.	Poaceae	Herb
74.	White Buffel Grass	<i>Cenchrus pennisetiformis</i>	Poaceae	Herb
75.	Bourne's Finger Grass	<i>Chloris bourne</i> Rang.	Poaceae	Herb
76.	Purpletop Rhodes	<i>Chloris inflat</i> aLink	Poaceae	Herb
77.	Siam Weed	<i>Chloris montan</i> aRoxb.	Poaceae	Herb
78.	Siam Weed / Christmas Bush	<i>Chromolaena odorat</i> a(L.) K & R	Asteraceae	Herb
79.	Golden Beardgrass False	<i>Chrysopogon aciculat</i> usRetz.	Poaceae	Herb
80.	Guria Grass	<i>Chrysopogon fulvu</i> sSpre	Poaceae	Herb
81.	Green Water Sedge	<i>Cyperus brevifoli</i> aRottb.	Cyperaceae	Herb
82.	Little Lovegrass	<i>Eragrostis mino</i> Host.	Poaceae	Herb
83.	Sticky Lovegrass	<i>Eragrostis nigra</i> Nees. Sd.	Poaceae	Herb
84.	Kadu Marvel	<i>Eremopogon foveolat</i> us	Poaceae	Herb

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85.	Hairy Spurge / Asthma	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Herb
86.	Flat spike Sedge / One Spike Fimbry	<i>Fimbristylis ovata</i> Burm. f.	Cyperaceae	Herb
87.	Globe Amaranth	<i>Gomphrena globosa</i> L.	Amaranthaceae	Herb
88.	Celon Heliotrope	<i>Heliotropium subulatum</i> L.	Boraginaceae	Herb
89.	Mission Grass	<i>Pennisetum polystachion</i> L.	Poaceae	Herb
90.	Panicled Foldwing	<i>Peristrophe bicalyculata</i> L.	Acanthaceae	Herb
91.	Indian Comet Grass	<i>Perotis indica</i> (L.) Kuntz.	Poaceae	Herb
92.	Jasminum Molle	<i>Polygala jacobii</i> Chan.	Polygalaceae	Herb
93.	Milkwort	<i>Polygala rosmarinifolia</i> Wight & Arn.	Polygalaceae	Herb
94.	Foxtail	<i>Setaria intermedia</i> Roem. & Schult.	Poaceae	Herb
95.	Yellow Foxtail	<i>Setaria pumila</i> (Poir.) Link.	Poaceae	Herb
96.	Celon Spinach	<i>Talinum portulacifolium</i> L.	Portulacaceae	Herb
97.	Wasteland Weed	<i>Tephrosia purpurea</i> L.	Fabaceae	Herb
98.	Panic Liverseed grass	<i>Urochloa panicoides</i> (L.) Be.	Poaceae	Herb
99.	Sleepy Morning	<i>Waltheria indica</i> L.	Sterculiaceae	Herb
100.	Soap Bush / Candelabra	<i>Acacia holosericea</i> L.	Mimosaceae	Shrub
101.	Century Plant	<i>Agave americana</i> L.	Agavaceae	Shrub
102.	Heyne's Alyce Clover	<i>Alysicarpus heyneanus</i> (L.) DC.	Fabaceae	Shrub
103.	Great Bougainvillea	<i>Bougainvillea spectabilis</i> DC.	Nyctaginaceae	Shrub
104.	Peacock Flower	<i>Caesalpinia pulcherrima</i> L.	Caesalpinaceae	Shrub
105.	Giant Milkweed	<i>Calotropis gigantea</i> L.	Asclepidaceae	Shrub
106.	Honey-Thorn	<i>Canthium parviflorum</i> L.	Rubiaceae	Shrub
107.	Tropical Sensitive Pea	<i>Cassia absus</i> L.	Caesalpinaceae	Shrub
108.	Smooth Rattlepod	<i>Crotalaria pallida</i> Dryand.	Fabaceae	Shrub
109.	Rattle Weed / Devil	<i>Crotalaria retusa</i> L.	Fabaceae	Shrub
110.	Hop Brush	<i>Dodonaea viscosa</i> L.	Sapindaceae	Shrub
111.	Painted Leaf Poinsettia / Mexican	<i>Euphorbia cyathophora</i> Murr.	Euphorbiaceae	Shrub
112.	Scarlet Jungle Flame	<i>Ixora coccinea</i> L.	Rubiaceae	Shrub
113.	White Jungle Flame	<i>Ixora finlaysonian</i> Wall.	Rubiaceae	Shrub
114.	Bellyache Bush	<i>Jatropha gossypifolia</i> L.	Euphorbiaceae	Shrub
115.	Candelabra Wattle	<i>Macrotyloma ciliatum</i> Wil.	Fabaceae	Shrub
116.	Wild Eggplant / Nightshade	<i>Solanum surattense</i> Burm.	Solanaceae	Shrub
117.	Satawari	<i>Asparagus racemosus</i> Willd.	Liliaceae	Climber
118.	Devil's Backbone	<i>Cissus quadrangularis</i> L.	Vitaceae	Climber
119.	Bitter Apple	<i>Citrullus colocynthis</i> L.	Cucurbitaceae	Climber
120.	Broom Creeper	<i>Cocculus hirsutus</i> L.	Menispermaceae	Climber
121.	Hedgehog Gourd	<i>Cucumis dipsaceus</i> Ehrenb.	Cucurbitaceae	Climber
122.	Muskmelon	<i>Cucumis trigonus</i> Roxb.	Cucurbitaceae	Climber
123.	Grey Snout Bean	<i>Rhynchosia canthi</i> DC.	Fabaceae	Climber
124.	The Whitelady	<i>Thunbergia fragrans</i> Roxb.	Acanthaceae	Climber
125.	Orange Climber	<i>Toddalia asiatica</i> L.	Rutaceae	Climber
126.	Indian Ipecac	<i>Tylophora indica</i> Burm. f.	Asclepidaceae	Climber

Report on Green Audit*Psidium guajava**Thuja orientalis**Oxalis latifolia**Duranta erecta**Nyctanthes arbor-tristis**Nerium oleander**Manilkara zapota**Phyllanthus emblica**Hibiscus rosa sinensis*

Report on Green Audit*Pongamia pinnata**Carica papaya**Roystonea regia**Cycas revoluta**Solanum nigrum**Phyllanthus niruri**Mimosa pudica**Eucalyptus globulus**Achyranthes aspera*

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Bauhinia purpurea



Mangifera indica



Michelia champaca



Terminalia catappa



Bambusa vulgaris



Lantana camara



Syzygium cumini



Azadirachta indica



Bouteloua dactyloides

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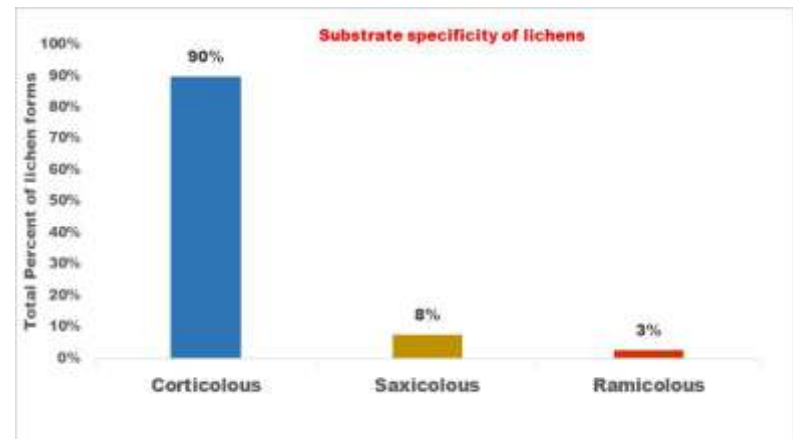
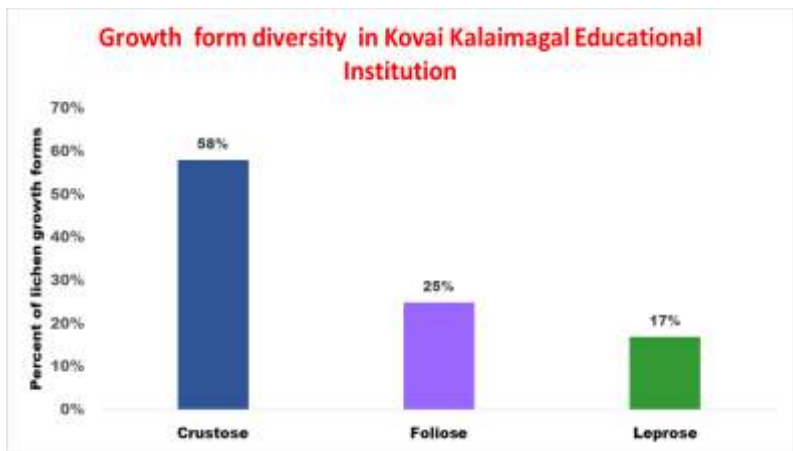
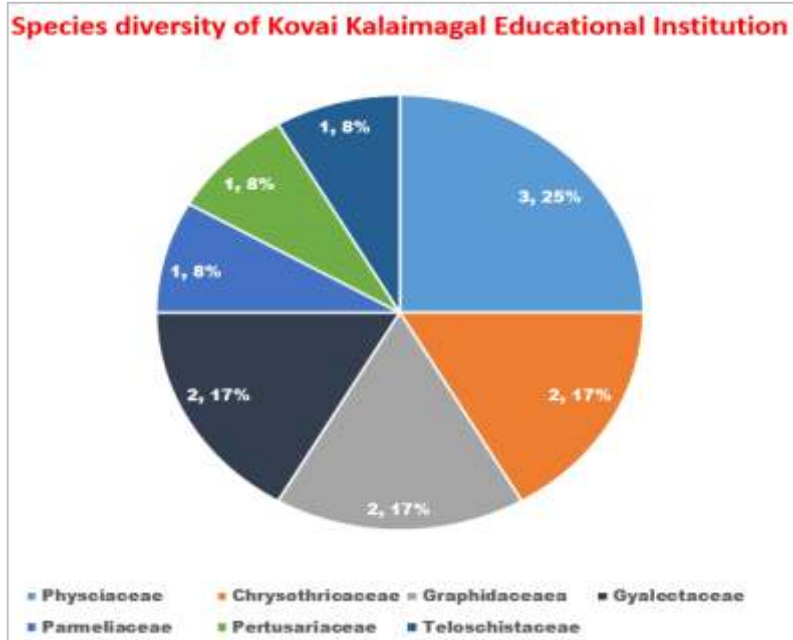
13.3.2.1. Lichen diversity at Kovai Kalaimagal Education Trust campus

Lichens are one of the most fascinating symbiotic organisms found worldwide. The lichens species are ubiquitous and common inhabitants of the bark of the tree, rock surface, soil etc. They are a lower group of plants coming under non-flowering plants that live in a variety of substrates under a wide range of environmental conditions with or without causing harm to the hosts. Ecologically, lichen plays important roles in soil formation; re-establishes life on earth; fixes atmospheric nitrogen; plant's health, ecology distribution, and in the formation of organic matter of habitat which in turn benefitting mosses in nutrient availability. A unique symbiotic association between a fungal and an algal partner results in a species called lichens in plant kingdom. In this relationship both the organisms are mutually benefited. The algal partner may be cyanobacteria or the blue green algae and this is responsible for the process of photosynthesis. The algae thus provide food or nutrition for the fungi too. The fungal partner in turn provides space and protection for the algae. The lichen is an autotrophic organism in the sense that they can produce their own food by the process of photosynthesis. Even though the lichen is made up of two different organisms, the characteristics of the lichen are entirely different from the original characteristics of the algal and the fungal partner. Lichens are classified as micro lichens and macro lichens in which the microlichens cover the substrate on which they grow in the form of a crust whereas macro lichens grow in the form of a bush or a leaf like structure. The major forms of lichens are a) Foliose lichens exhibit a flat leaf like thallus, b) Fruticose lichens exhibit erect, pendulous and bushy thallus, c) Squamulose lichens exhibit thallus with minute, scale like squamules and d) Crustose lichens exhibit flat crust shaped thallus.

Lichen diversity at KKET campus showed a total of 12 different lichens species belonging to 6 genera and 6 families. Three species accounted for 10% of total lichen diversity were identified up to species level and 9 were identified to genus level. The observation on lichen diversity revealed that two types of lichens genus belonging to *Buellia* spp., and *Lecanora* spp. were accounted 8% diversity and two types of lichens genus belonging *Caloplacaspp.*, *Dimeralla* spp., and *Pertusariaspp.* were accounted 6% and about 23% lichens were found to be one single species in each genus. Among 12 species of lichens, crustose growth form of lichens was leading with 7 species (58%) followed by foliose growth forms with 3 species (25%) and leprose type with 2 species (17%).

Around 23 % representative specimens belonged to Physciaceae were found to be leading among 5 families. One quarter (15%) lichen species was belonged to Parmeliaceae. and most of the species belonged to Physciaceae Parmeliace were *Parmotrema praesorediosum*, *P.grayanum*, *Parmotrema austrosinense*, *Flavoparmelia caperata* and *Dirinaria* spp., *Heterodermia leucomelos*, *Heterodermia spaciiosa* *Phaeophyscia hirsuta* and *Physcia tribacia* respectively. On the basis of substrate specificity, lichens were categorized under three major types. It was illustrated that 3 species were identified occurring on rock followed by 6 species found attached to bark of the tree, 1 species *Heterodermia obscurata* collected from both the rock (saxicolous) and bark of the tree (corticolous).

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Lichendiversity of Kovai Kalaimagal Education Trust campus with respect to family, substratum and growth forms in genus and family wise classification

S.No	Lichendiversity of Kovai Kalaimagal Educational Trust campus	Family	Growth forms
1.	<i>Buellia spp.</i> ,	Physciaceae	Crustose
2.	<i>Caloplaca exsecuta (Nyl.) Dalla Torre &</i>	Teloschistaceae	Crustose
3.	<i>Chrysothrix chlorine (Ach.) J.R.Laundon</i>	Chrysothricaceae	Leprose
4.	<i>Dimerella nepalensis Thor & Vezda</i>	Gyalectaceae	Crustose
5.	<i>Dimerella pineti (Achi.) Vezda</i>	Gyalectaceae	Crustose
6.	<i>Dirinara applanata (Fee) D. D. Awasthi</i>	Physciaceae	Foliose
7.	<i>Glyphis scyphulifera (Ach.) Staiger</i>	Graphidaceae	Crustose
8.	<i>Graphis rimulosa var.parallela Mull. Arg.</i>	Graphidaceae	Crustose
9.	<i>Heterodermia hypocaesia (Yasuda ex Rasanen) D. D. Awasthi</i>	Physciaceae	Foliose
10.	<i>Parmotrema austrosinense (Zahlbr.) Hale</i>	Parmeliaceae	Foliose
11.	<i>Peltula euploca</i>	Chrysothricaceae	Leprose
12.	<i>Pertusaria colorata Awasthi</i>	Pertusariaceae	Crustose

13.3.1.2. Algal diversity at Kovai Kalaimagal Education Trust campus

Chlamydomonas ovoidae, *Scytonema varium*, *Oscillatoria curviceps*, *Oedogonium microgonium*, *Spirogyra perticalis*, *Volvox aureus*, *Microcystis elongate* and *Cladophora albid* belonging to the class of Cyanophyceae, Chlorophyceae and Bacillariophyceae. The families Chlorellaceae, Closteriaceae, Desmidiaceae, Radiococcaceae, Ulotrichaceae, Uronemataceae and Oedogoniaceae were represented by single genus and species. Chlorophyceae plays an important role in both terrestrial and aquatic ecosystem as most of the members are found to be ecologically important. The highest diversity of Chlorophyceae indicated relatively good health of atmosphere. The presence of these algal species in abundance can be concluded that the KKET ecosystem has high amount of organic nutrients in soil and rock. The occurrence of rich algal flora results generally at a place with high level of nutrient together with favourable environmental conditions.

13.3.1.3 Mushroom diversity in Kovai Kalaimagal Education Trust campus

Mushrooms are white rot fungi and edible basidiomycete, which contain high protein; rich in mineral contents and medicinal properties. At present three mushrooms are being cultivated in India. These are the white mushroom, the paddy-straw mushroom and the oyster mushroom. All these are the most popular and economically sound to grow and is extensively cultivated throughout the world. However, due to its moderate temperature requirement, its cultivation and growth are restricted to the cool climatic areas and to the winter in the plains of Tamil Nadu region. Mushroom growth yield is influenced by the type of compost, spawn, temperature, % of moisture and also affected by the pests and disease causing agents. There has been extensive concern in recent years, as far as the production of fungal protein from domestic, agricultural and industrial wastes. Since mushrooms have a very short life, it should reach to consumers within a short time or immediately canned. Mushroom growth is determined by means of carbohydrate content in the substrates like paddy straw, sugarcane molasses, saw wood dust and other plant waste materials which should be high yielding, visually

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attractive, having desirable flavour, and resistance to adverse climate and pests and diseases.

KKET campus has various mushroom types covering poisonous, edible and medicinal varieties such as white mushroom (*Agaricus bisporus* and *Agaricus laccata*), the paddy-straw mushroom (*Volvariella volvacea*), oyster mushroom (*Pleurotus sajorajau* and *P. florida*), button mushroom (*Omphalotus olearius*) and other mushroom types such as *Amauroderma conjunctum*, *Amylosporopus campbellii*, *Daldinia concentrica*, *Ganoderma applanatum*, *Phallus atrovolvatus*, *Laccaria laccata*, *Termitomyces fuliginosus*, *Pycnoporus cinnabarinus* and *Volvariella bombycina*.

13.3.2. Fauna Diversity in Kovai Kalaimagal Education Trust campus

13.3.2.1. Birds Diversity in Kovai Kalaimagal Education Trust campus

The observations on fauna diversity indicated that the KKET campus has a large number of living as well as visiting animals, birds, reptiles and insects including birds. A total number of 73 birds belonging to the 24 species were recorded from different habitats during winter and summer, of them one of which were endemic to the western Ghats like purple rumped sunbird. Totally 52 species of birds representing 14 families and 8 orders were observed during this study, passeriformes constituted the predominated group representing 12. Total number of 14 bird species, out of them 4 species were migrant, 6 species were local migrant during winter and summer season because of unfavourable environment and low availability of food resources. Migratory bird species like Red winged crested cuckoo, Indian cuckoo, forest wag tail, Yellow browed bulbul, Paddy field warbler, small green billed malkhoa, Alexandrine parakeet, Rose ringed parakeet and red whiskered bulbul.

Birds Diversity in Kovai Kalaimagal Education Trust campus

S.No	Common Name	Scientific Name
1.	Eurasian hoopoe	<i>Upupa epops</i>
2.	Red vented bulbul	<i>Pycnonotus cafer</i>
3.	Oriental magpie-robin	<i>Copsychus saularis</i>
4.	Lark	<i>Alaudidae</i>
5.	Black kite	<i>Milvus migrans</i>
6.	Bay backed shrike	<i>Laniidae</i>
7.	Eurasian collared dove	<i>Streptopelia decaocto</i>
8.	Copper smith barbet	<i>Megalaima haemacephala</i>
9.	Rosy starling	<i>Pastor roseus</i>
10.	Pipit	<i>Anthus</i>
11.	Pied cuckoo	<i>Clamator jacobinus</i>
12.	Grey wagtail	<i>Motacilla cinerea</i>
13.	Indian robin	<i>Saxicoloides fulicatus</i>
14.	Pond heron	<i>Ardeola</i>

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15.	Yellow billed babbler	<i>Turdoides affinis</i>
16.	Greater coucal	<i>Centropus sinensis</i>
17.	Asian koel	<i>Eudynamys scolopaceus</i>
18.	Indian roller	<i>Coracias benghalensis</i>
19.	Indian peafowl	<i>Pavo cristatus</i>
20.	Rufous treepie	<i>Dendrocitta vagabunda</i>
21.	White wagtail	<i>Motacilla alba</i>
22.	Purple sunbird	<i>Cinnyris asiaticus</i>
23.	Purple rumped sunbird	<i>Leptocoomo zeylonica</i>
24.	Black drango	<i>Dicrurus macrocercus</i>



House Crow
Corvus splendens



House Sparrow
Passer domesticus



Rose ringed-Parakeet
Psittacula krameri



Blue Rock Pigeon
Colmuba livia

13.3.2.3. Butterflies in Kovai Kalaimagal Education Trust campus

KKET campus has five family level diversities such as Papilionidae, Pieridae, Nymphalidae, Lycaenidae and Hesperidae in which Common butterflies species such as Mormon, Rose, Birdwing, Emigrant, Grass yellow, Gull Wanderer, Emigrant, Small Orange Tip, Plain Orange Tip, White Orange Tip, Yellow Orange Tip, Pioneer

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Chocolate, Pansy, Baron, Palmfly, Bush, Brown, Eggfly, Leopard, Sailer, Evening, Brown, Eggfly, Pansy, Grey and Pansy are commonly found.

List of Butterflies recorded in Kovai Kalaimagal Education Trust campus

S.No	Common Name	Scientific Name	Family
1.	Common Bluebottle	<i>Graphium sarpedon</i>	Papilionidae
2.	Common Mime	<i>Chilasaclytia</i>	Papilionidae
3.	Red Helen	<i>Papilio helenus</i>	Papilionidae
4.	Paris Peacock	<i>Papilio paris</i>	Papilionidae
5.	One Spot Grass Yellow	<i>Eurema andersonii</i>	Pieridae
6.	Small Salmon Arab	<i>Colotis amata</i>	Pieridae
7.	Crimson Tip	<i>Colotis danae</i>	Pieridae
8.	Pioneer	<i>Belenois aurota</i>	Pieridae
9.	Angled Castor	<i>Ariadne ariadne</i>	Nymphalidae
10.	Blue Tiger	<i>Tirumala limniace</i>	Nymphalidae
11.	Common Fourring	<i>Ypthima huebneri</i>	Nymphalidae
12.	Common Lascar	<i>Pantoporia hordonia</i>	Nymphalidae
13.	Tamil Yeoman	<i>Cirrochroa thais</i>	Nymphalidae
14.	Common Cerulean	<i>Jamides celeno</i>	Lycaenidae
15.	Common Grass Dart	<i>Taractroceramaevius</i>	Hesperiidae
16.	African Marbled Skipper	<i>Gomalia elma</i>	Hesperiidae
17.	Pale Palm Dart	<i>Telipotoclon</i>	Hesperiidae
18.	Small Branded Swift	<i>Pelopidas mathias</i>	Hesperiidae



Tailed Jay
Graphium agamemnon



Baronet
Euthalia nais



Common Albatross
Appias albatross



Blue Tiger
Tirumala limniace

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13.3.2.4. Diversity of Reptiles in Kovai Kalaimagal Education Trust Campus

Reptiles are air-breathing vertebrates covered in special skin made up of scales, bony plates, or a combination of both. They include crocodiles, snakes, lizards, turtles, and tortoises. Because of their slow metabolism and heat-seeking behavior, reptiles are cold-blooded animals in nature. They usually have scales on their skin and prefer to live in sunny and warm areas. KKET campus has a sum of 10 reptile species. The commonly found reptile species are Common Krait (*Bungarus caeruleus*), Spectacled Cobra (*Naja Naja*), Common Indian Bronzeback (*Dendrelaphis tristis*), Common Vine Snake (*Ahaetullana suta*), Common Kukri Snake (*Oligodonarnensis*), Fanthroated and Common or Brahminy Skink (*Mabuyacarinata*).

List of Reptiles found in Kovai Kalaimagal Education Trust campus

S.No.	Common Name	Scientific Name	Local Name
1.	Sand Boa	<i>Eryx johnii</i>	Mannulumbi Paambu
2.	Common Indian Bronzeback	<i>Dendrelaphis tristis</i>	Komberi Moorken
3.	Common Vine Snake	<i>Ahaetullana suta</i>	Pachai Paambu
4.	Common Kukri Snake	<i>Oligodonarnensis</i>	Paul Virian
5.	Indian Garden Lizard	<i>Calotes versicolor</i>	Oonan
6.	Indian Monitor Lizard	<i>Varanus bengalensis</i>	Udumbu
7.	Green Forest Lizard	<i>Calotes calotes</i>	Pachai Oonan
8.	South Asian Chameleon	<i>Chamaeleo zeylanicus</i>	Pachondhi
9.	South Indian Rock Agama	<i>Psammophilus dorsalis</i>	Sentahalai Oonan
10.	Russell's Viper	<i>Daboia russelii</i>	Kannadi Virian

13.3.2.5. Mammals in Kovai Kalaimagal Education Trust campus

Mammals are a group of vertebrate animals constituting the class Mammalia, and characterized by the presence of mammary glands which in females produce milk for feeding (nursing) their young, a neocortex (a region of brain), fur or hair, and three middle ear bones. These characteristics distinguish them from reptiles and birds, from which they diverged in the Carboniferous. The largest orders are the rodents, bats and Eulipotyphla (hedgehogs, moles and shrews). The observation on diversity of mammals in KKET indicated that around 10 species of mammals are commonly distributed. The commonly found mammals are Asian Elephant, Wild Boar, Spotted Deer, Black-naped Hare, Three-striped Palm Squirrel, Common or Grey Mongoose, Indian Flying Fox, Short-nosed Fruit Bat, House Rat and Indian Mole-rat.

S.No.	Common Name	Scientific Name	Common Name
1.	Asian Elephant	<i>Elephas maximus</i>	Yaana
2.	Wild Boar	<i>Sus scrofa</i>	Kaatu Pandri
3.	Spotted Deer	<i>Aix axis</i>	Pulli Maan
4.	Black-naped Hare	<i>Lepus nigricollis</i>	Muyal
5.	Three-striped Palm Squirrel	<i>Funambulus palmarum</i>	Anil
6.	Common or Grey Mongoose	<i>Herpestes edwardsi</i>	Keeri Pillai
7.	Indian Flying Fox	<i>Pteropus giganteus</i>	Periya Vowal
8.	Short-nosed Fruit Bat	<i>Cynopterus sphinx</i>	Vowal
9.	House Rat	<i>Rattus rattus</i>	Sundeli
10.	Indian Mole-rat	<i>Bandicota bengalensis</i>	Peruchali

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13.3.2.6. Amphibians in Kovai Kalaimagal Education Trust campus

Amphibians are ectothermic, tetrapod vertebrates of the class Amphibia. All living amphibians belong to the group Lissamphibia. They inhabit a wide variety of habitats, with most species living within terrestrial, fossorial, arboreal or freshwater aquatic ecosystems. Thus amphibians typically start out as larvae living in water, but some species have developed behavioural adaptations to bypass this. The observation on diversity of Amphibians in KKET indicated that around 11 species are Amphibians are commonly distributed. The commonly found amphibians are listed.

The young amphibians generally undergo metamorphosis from larva with gills to an adult air-breathing form with lungs. Amphibians use their skin as a secondary respiratory surface and some small terrestrial salamanders and frogs lack lungs and rely entirely on their skin. They are superficially similar to lizards but, along with mammals and birds, reptiles are amniotes and do not require water bodies in which to breed. With their complex reproductive needs and permeable skins, amphibians are often ecological indicators; in recent decades there has been a dramatic decline in amphibian populations for many species around the globe.

The earliest amphibians evolved in the Devonian period from sarcopterygian fish with lungs and bony-limbed fins, features that were helpful in adapting to dry land. They diversified and became dominant during the Carboniferous and Permian periods, but were later displaced by reptiles and other vertebrates. Over time, amphibians shrank in size and decreased in diversity, leaving only the modern subclass Lissamphibia. The three modern orders of amphibians are Anura (the frogs), Urodela (the salamanders), and Apoda (the caecilians). The number of known amphibian species is nearly 90% are frogs. The smallest amphibian (and vertebrate) in the world is a frog from New Guinea (*Paedophryne amauensis*). The study of amphibians is called Batrachology, while the study of both reptiles and amphibians is called herpetology. The observation on diversity of Amphibians in KKET indicated that around 11 species are Amphibians are commonly distributed. The commonly found amphibians are listed.

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Ambhíbians in Kovai Kalaimagal Education Trust campus

S.No	Common Name	Scientific Name
1.	Indus Valley Toad	<i>Firouzophrynus stomaticus</i>
2.	Waynad Bush Frog	<i>Pseudophilautus wynaadensis</i>
3.	Anil's Bush Frog	<i>Raorchestes anili</i>
4.	Ochlandra Shrub Frog	<i>Raorchestes ochlandrae</i>
5.	Large Ponmudi Bush Frog	<i>Raorchestes ponmudi</i>
6.	Variable Bush Frog	<i>Raorchestes akroparallagi</i>
7.	Jayaram's Bush Frog	<i>Raorchestes jayarami</i>
8.	Anamallais Indian Frog	<i>Indirana brachytarsus</i>

13.3.2.7. Grasshopper diversity Kovai Kalaimagal Education Trust Campus

Grasshoppers are a group of insects belonging to the suborder Caelifera. They are among what is probably the most ancient living group of chewing herbivorous insects. They are typically ground-dwelling insects with powerful hind legs which allow them to escape from threats by leaping vigorously. As hemimetabolous insects, they do not undergo complete metamorphosis; they hatch from an egg into a nymph or "hopper" which undergoes five moults, becoming more similar to the adult insect at each

Developmental stage. The grasshopper hears through the tympanal organ which can be found in the first segment of the abdomen attached to the thorax; while its sense of vision is in the compound eyes, the change in light intensity is perceived in the simple eyes (ocelli). At high population densities and under certain environmental conditions, some grasshopper species can change colour and behavior and form swarms. Grasshoppers are plant-eaters, with a few species at times becoming serious pests of cereals, vegetables and pasture, especially when they swarm in their millions as locusts and destroy crops over wide areas. Grasshoppers have had a long relationship with humans. Swarms of locusts can have devastating effects and cause famine, having done so since Biblical times. The study of grasshopper species is called Acridology.

The observation on diversity of Grasshoppers in KKET indicated that around 8 species are Amphibians are commonly distributed. The commonly found Grasshoppers are *Acrida exaltata*, *Diaboloatantops pinguis*, *Eyprepocnemis alacris*, *Sphingonotus longipennis*, *Atractomorpha crenulata*, *Chrotogonus oxypterus*, *Simertula vidhyavadhiaae* and *Trigonocorypha unicolor*,

13.3.2.8. Termites Diversity in Kovai Kalaimagal Education Trust Campus

Termites are eusocial insects that are classified at the taxonomic rank of infraorder Isoptera, or alternatively as epifamily Termitoidae, within the order Blattodea (along with cockroaches). Termites were once classified in a separate order from cockroaches, but recent phylogenetic studies indicate that they evolved from cockroaches, as they are deeply nested within the group, and the sister group to wood eating cockroaches of the genus *Cryptocercus*. More recent estimates suggest they have an origin during the Late



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Jurassic with the first fossil records in the Early Cretaceous. Although these insects are often called "white ants" they are not ants, and are not closely related to ants. Termites mostly feed on dead plant material and cellulose, generally in the form of wood, leaf litter, soil, or animal dung. Termites are major detritivores, particularly in the subtropical and tropical regions, and their recycling of wood and plant matter is of considerable ecological importance.

Termites are among the most successful groups of insects on earth, colonising most landmasses. Their colonies range in size from a few hundred individuals to enormous societies with several million individuals. The observation on diversity of Termites in Kovai Kalaimagal Educational Institutions indicated that around 7 species are Termites are commonly distributed. The commonly found Termites are *Odontotermes anamallensis*, *O. assumuthi*, *O. globicola*, *O. feae*, *O. horai*, *Trivitermes fletcheri* and *Nasutitermes indicola*. These Termites are belonging to three different Genera such as *Odontotermes*, *Trivitermes* and *Nasutitermes* recorded in KKET campus.

13.4. An account of more Oxygen producing and Carbon-di-oxide absorbing plants in the Campus

There are some plants which are being considered highly efficient in oxygen production and carbon-di-oxide absorption which in turn reflected the quality of the green campus. If more oxygen is made available in the campus naturally, the stakeholders may be free from various cardiovascular and pulmonary problems and breathing troubles. The snake plant (*Sansevieria zeylanica*) otherwise known as the mother-in-law's tongue and Gerbera Daisy (*Gerbera jamesonii*) plant are unique for its night time oxygen production, and ability to purify air through the removal of various toxic gases in the atmosphere. Although there are options available for increasing oxygen by reducing CO₂ through means such as oxygenators and air purifiers, there are a variety of natural alternatives for increasing air quality that are beneficial for both body and mind. KKET campus has a maximum number of more oxygen producing and CO₂ absorbing plants such as *Areca Palm*, *Money plant*, *Neem tree*, *Tamarind tree*, *Ficus*, *Bamboo*, *Arjun tree*, *Magizhambboo*, *Marudhu*, *Maramalli*, *Nettilingam*, *Manja arali*, *Puvarasu* and *Pongam* trees.

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13.5. Lawns, Trees, Herbs, Shrubs, Climbers and Lianas in Kovai Kalaimagal Educational Trust Campus

Lawns are gazing features of unutilized land made to cover the soil with green grass for the ambience of the place to have a greenish look. Lawn provides a hollow space among the building structures. The shaded trees in between the grass lawn, pathways and garden benches are meaningful lineaments to the green campus. The advantage of lawn is that it prevents the unintended weeds growth in the unutilized

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landscape areas. Trees that are native to land with medicinal value, ethnicity and environmental value add an advantage to green building. Purpose of trees is to provide shade, atmospheric CO₂ sequestration and supply of oxygen that serves the purpose of a green campus. Herbs are small plants with medicinal values and shrubs are small plants with thick stems and can hold soil to some extent than the herbs and serve the purpose of soil erosion. Climbers can grow with the support of wall structures and the climbers can enhance the wall value with greeneries.

KKET campus has a large number of trees, herbal plants, shrubs, climbers, lianas, twiners and lawns. It is further observed that all the plants are growing profusely and showing healthier free from pests and diseases attack. A total of 12 type of shrub species are available in the campus. The commonly available native as well as wild shrub species in the KKET campus are Kakithapoo (*Bougainvillea spectabilis*), Madhanakamaboo (*Cycas revoluta*), Pigeon-berry (*Duranta plumierii*), Nilamulli (*Eranthemum roseum*), Sembaruthi (*Hibiscus rosasinensis*), Vetchi (*Ixora coccinea*), Malli (*Jasminum sambac*) and Arali (*Nerium odorum*).

Similar to that of shrubs, there are 17 kinds of herbs available in the Kovai Kalaimagal Educational Institutions campus. The predominant species of herbs available in the KKET campus are Kunukkuth thukki (*Micrococca mercurialis*), Melaanelli (*Phyllanthus maderaspatensis*), Keelanelli (*Phyllanthus niruri*), Otramullu (*Priva leptostachya*), Adai-otti (*Pupalia lappacea*), Kirantinayan (*Ruellia prostrata*), Pattasukai (*Ruellia tuberosa*), Vettu kayathalai (*Tridax procumbens*) and Kattu paruthi (*Turnera ulmifolia*).

The existence of climber, creepers, twiners and lianas species available which accounted more than 10 species in the KKET campus are Kayathalai (*Allamanda cathartica*), Kovai (*Coccinia indica*), Kattu-kodsi (*Cocculus hirsutus*), Amirtaval (*Tinospora cordifolia*) and Sinthal (*Monstera deliciosa*). The major grasses are Periapullu (*Aristida pinnata*), Chevvarakupul (*Chloris barbata*), Arugam Pillu (*Cynodon dactylon*), Korai Pollu (*Cyperus rotundus*) and Crowfoot grass (*Dactyloctenium aegyptium*). Creepers are plants with weak stem that grow along the ground, around another plant, or up a wall by means of extending stems or branches. Climbers are plants whose stems are weak, so they climb up trees and walls for support to grow. They are the type of herbs and shrubs which are green in colour and grow vigorously without any pest and disease attack which are observed in KKET campus.

13.6. Establishment of different Gardens Kovai Kalaimagal Educational Trust Campus

Growing many types of herbal plants having medicinal importance in the campus becomes more attractive and useful if concept gardens are maintained. Medicinal plant gardens can contain the locally available medicinal plants, RET (Rare Endangered Threatened) listed plants and those plants are most useful in terms of economic importance. The tree garden / arborea can be planted based on the zodiac signs which would attract the public and students, faculties, staff members, employees and educate them based on their uses. In the tree gardens, trees as linings all over the campus can act as oxygen corridors. Native trees along with trees like *Azadirachta Pongamia* and

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Ficus species can be cultivated at the maximum as these plants are used to remove the dust particles and carbon lead from the air and purifies the air considerably. Similarly, the ornamental plants with beautiful flowers can be maintained in the frontage gardens of campus for attraction and good ambience. This will give an overall aesthetic look and also provide fresh air for healthy respiration to the stakeholders.



13.7. Natural Topography and Vegetation

Natural topography means the original geographical features of the campus, around 15- 20% of the organization should have the natural features like rocks, water resources, slopes, landscape, pathways, etc. and the altered topography can be accounted for, it is facilitated. The vegetation in the land alone is considered as they are part of the natural topography. The vegetation in the artificially created structures are also accounted for when it is reported more than 25% of the claimed green campus audit site. Vegetation is the cultivation of a bunch of plants irrespective of the plant *taxa* for the covering of the area or ground topography. Natural topography is better appreciated with wild vegetation than the artificially created topography like pathways and parking areas. The observation at KKET campus indicated that more than 65% natural topography and vegetation have been maintained properly. Further, there was no

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anthropogenic activity in some of the exterior side of the campus.

13.8. Rainwater Harvesting System and Percolation Pond

Rainwater harvesting system is a traditional old practice not only in drought prone areas and also in areas having seasonal rainfall. The Indian traditional rainwater harvesting is being practiced in various parts of the country to improve the ground water status. Now the threatening features of the lower ground level of water has created a revamp of newly featured rainwater harvesting systems. Indian traditional rainwater harvesting systems are constructed based on three modes either direct pumped, indirect pumped or by gravity alone in the campus. In addition, lakes, ponds, water channels and any other water reservoir methods are considered as the rainwater harvesting system. The green campus should have adopted any of the above said modes of rainwater harvesting or any new methods that has the benefit of conserving the water resource as well. A small square shaped pit containing gravels and sands may be constructed near the building in which rainwater will be harvested from the roof of the building using a pipe. During the audit, there are three well developed rain harvesting systems such as 1) pond, 2) square shaped pit containing gravels and sands and 3) water channels connected with a square shaped pit observed with KKET. Rainwater harvesting structures and recharge wells have been commissioned in the campus at different locations.

13.9. Landscape design and Soil Erosion Control

Landscape management is the care of land to make sure that landscapes can fulfil the needs and aspirations in an effective and sustainable manner for current and future stakeholders. It is an action that forms a perspective of sustainable development, to ensure the preservation of a panorama, in order to help and harmonize changes which are added through social, monetary and environmental methods. Landscape design is an important feature for any disasters to control especially with respect to the soil erosion. In general, soil erosion occurs if the design of the land is not altered so as to prevent the slope features by strong vegetation and use of a plant buffer zone as safe for escape of nutrients or fertilizers entering the streams. When the slope features are altered, adequate vegetation can alone be enough to prevent soil erosion. The observation revealed that KKET campus has very good landscape design without disturbing the natural vegetation. KKET is located in near the Vellingiri hills of Western Ghats located in Coimbatore, Tamil Nadu. The Organization is almost very close to the hills which reflected the floral and fauna diversity along with soil and environmental conditions. The Organization is established without damage of the original landscape and a large number of trees are growing naturally which control the soil erosion significantly. It is observed that there was no empty land, wherein, maximum number of trees are allowed to grow which in turn to maintain the original climatic conditions. Contour ploughing is being done at right angles to the slope wherever possible and ridges and furrows are properly maintained to break the flow of water down to the empty land. These activities are widely adopted to control soil erosion in the campus of KKET.

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13.10. Operation of Water irrigation, Drip and Sprinkler Irrigation methods

Maintaining the green campus and water conservation mechanisms should be applied efficiently in the campus. Well planned water irrigation systems like sprinklers and drip should be implemented in the entire green area of the campus for an effective water management system. This can be implemented only when the plantations are well planned. The tree growing areas can be connected with drip irrigation and medicinal plants growing areas and flower gardens can be connected with sprinkler irrigation. KKET has taken sufficient efforts to maintain the plants greenish and frequency of watering to the plants. A register is maintained to note down the timing of watering the plants and quantity of water poured every time. Internal auditing of time of plantation, number of times the plants are watered and growth parameters of the plants in the campus is being carried out.

13.11. Importance of Biodiversity Conservation

The campus should be a mini biodiversity conservation area, wherein, more greenery due to native plant species, medicinal plant garden, concept gardens, flowering plants that attract bees, birds, beetles and other animals like squirrels should be monitored as ecosystems. Shade giving trees in the paths, flowering trees in the avenues and fruit trees at the back yards also would attract birds, bees, butterflies and squirrels. Maintaining small ponds/open water sources and reservoirs will attract these small harmless animals to the campus. KKET campus is free of exotic plants that cause threat to the natural vegetation. It is like a mini bio-reserve rich in native species and endemic plants. A complete data on the soil type, water holding capacity and soil nutrition in the campus is being thoroughly studied internally or with the Government agriculture departments. It is useful for cultivation of various native and wild plant species and also helps in choosing the proper irrigation system.

13.12. Pedestrian Path facility at KKVai Kalaimagal Educational Trust campus

The concept of pedestrian path is to give safe space to walk freely by the pedestrian. It is very important in the green campus in terms of freely walk pedestrians or people going on foot without any obstructions. The pedestrian path is otherwise called as zebra crossing by the combination of black and white stripes remind to characterize the zebra. This path is specially designed space to the stakeholders to walk freely without any disturbance. It is useful for cross walk and easy to recognize to walk by means of wide black and white colour combination of lines and authorize to walk while crossing and walking on the foot. In addition, pedestrian path are created in the green campus along with road side which meant for walking only using special cement bricks and stones. The pedestrian path aims to end circulation not only cars, buses, vans, trucks and other vehicles but also giving safe space to the pedestrians, where cross and pass through blocks and also forcing vehicles to comply with it. KKET campus is having very good facility in creating pedestrian path for stakeholders.

13.13. Use of Biofertilizers, Organic and Green manures

Natural or eco-friendly methods should be used to grow plants vigorously in the campus which could reduce the environmental pollution. Use of biofertilizers, organic manures (cow dung, vermicompost and plant wastes and litters) and green manures to grow healthy plants in the medicinal plant garden, kitchen garden and terrace garden

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should be ensured to keep the campus organic. The plant waste such as fallen leaves, stems, fruits, nuts, seeds and other plant parts should be used to make green manures. A concrete or ground level green manure production unit and vermicomposting units will help to convert all the plant and animal based wastes into green/organic manures. This will be a healthy way of solid litter waste management in the campus. Minimal use of chemical fertilizers as part of integrated nutrient management system is acceptable but nil use of chemical fertilizers is highly appreciable and also helps to keep the campus more of an organic ecosystem. The soil, air, water and sunlight are the four major natural resources any campus gets. Proper use and conservation of these resources are mandatory in green campus audit sites. The available resources and their utilization should be accounted for from time to time. Management of the right way of utilization of these resources with the vision of sustainability should be carried out by framing a committee led by the Head of the Institution concerned. Biofertilizers such as Nitrogen fixing bacteria, Potassium and Phosphorus solubilizing bacteria, Potassium mobilizing fungi (VAM), farm yard manure, dried cow dung manure, vermicompost manures and biofungicides and biopesticides are extensively used in KKET to cultivate plants. Agrochemicals, chemical fertilizers (urea, murate of potash, sulphate of poash, rock phosphate, etc.), pesticides and fungicides are not used. These practices are very well appreciated because air, water and soil pollution due to use of agrochemicals is eradicated which in turn to improve the soil health significantly.



**Vermicompost and Organic Manure Production Facility at
KKET, Coimbatore, Tamil Nadu.**

13.14. Conduct of Outreach programmes for dissemination of Green Campus motto and Green pledge initiatives by Eco club, Nature club, Associations, Cells, Forums, NCC and NSS bodies in Green Campus initiatives

Professional implementation of all the Eco plans in the campus should be done through the Eco clubs, Nature clubs, Science clubs, Youth Red cross units, Fine Arts clubs, Women cell, Associations, Forums, SSL, NCC (National Cadet Corps) and NSS (National Service Scheme). All the students, members of staff and employers should be mandatory members of the club and should do tree planting and maintenance of greenery in the campus periodically. Conducting frequent seminars, conferences,

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workshops, awareness rallies, etc. on topics relevant to the environment is necessary to educate and create awareness among the students and staff members. In addition, student's associations, cells, clubs and forums should be the first hand receivers of all the new plans proposed by the Government such as Swachh Bharath Abhiyan and Jal Shakti Abhiyan under Clean India Mission and implement the same in the campus. The KKET has well developed NCC, NSS, Swachh Bharath Abhiyan under Clean India Mission. These bodies are actively involved in tree planting programmes and cleaning the surrounding areas of tribal, rural and urban people across Coimbatore, Erode and Nilgiris Districts of Tamil Nadu. KKET is conducting a large number of activities to conserve the nature and to teach about the importance of environment to rural, tribal and urban people.



Awareness programmes on the green campus initiatives and dissemination of green motto and pledges are accounted in a sustainable manner. Its benefits and self-sustainability are being projected for wider centric on earth and Ecology conservation. Innovative practices that add up credentials in implementing the green campus which needs to be promoted in the awareness programme to the students and staff members including public domain. Technology driven solutions initiated by the green campus organization are periodically disseminated and documented successively for propagating the attitude of the green campus in wider masses. KKET has taken sufficient attempts to disseminate the green campus motto and green pledge such as 'Don't cut trees', 'Don't use plastic bags', 'Don't waste waters', 'Plastic Free Zones' and 'Preserve the Natural Resources' and etc. among the students and staff members in the campus.

KKET is implemented the Government schemes (Swachh Bharath Abhiyan under Clean India Mission) to give pure and safe water to rural people and teach the importance of cleanliness of toilets and restrooms to people living in Marudhamalai hills. These activities are very important in view of the immediate vicinity to take up developmental activities and conducted Participatory rural appraisal programmes. It is involving the socioeconomic status of the inhabitants, natural resources, traditional knowledge systems, cropping patterns, etc. of the rural and tribal people living in Thondamuthur surrounding hills. KKET is also focusing on the development of women, youth, children and dalits and to identify the extension and training needs of the target group through the Department of Women Studies and Career Guidance. It provides the vocational training to marginal farmers to overcome the problem of seasonal employment. Some of areas identified are goat farming, mushroom cultivation, vermicomposting, bee keeping, ornamental fisheries, organic farming and medicinal plant cultivation.

KKET helps to develop social commitment and to expose the students to get sensitized to social realities and to build a link between the student community and the

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wider community. It enhances the social interaction, inter-personal communication skills and develop emotional maturity of students. It also helps students in total and integrated personality development. KKET facilitates to prepare the students for future life, by developing qualities such as cooperation, team spirit, leadership, discipline and development of creative talents including to boost the self-confidence of students.

13.15. Establishment of Aquarium and Aquatic plants

Growing fishes in the small ponds will keep the environment pleasant. In the closed environment like corridors and the front offices, auditoriums and gallery classes placing the fish aquarium as well as plant aquarium will improve the scenic value of the place bringing peace to the people. The fish water waste also can be used as manure for growing potted indoor plants. Growing *Lotus*, *Lilly*, *Hydrilla* and other water plants will give a pleasant and calm environment and growing fishes like *Guppies* can keep the water clean and neat. The fountains and small ponds can be built in the frontages to give an aesthetic look and also growing water plants in these ponds will help to maintain the aesthetic sense of the environment in greenish. KKET campus has a good aquatic site in which aquatic plants and birds are living generously.

13.16. Academic credentials: Projects, Dissertations and Thesis work

Project, Dissertation and Thesis works are academic effort credentials that always fosters the innovative ideas on thinking and implementation of new innovative approaches. Applied research work of the faculties, staff and student members should be implemented within the campus owing to the credential of the research. Those works indicating the significance of empowering the green campus can be implemented or adopted in other organizations. If the innovation is capable of developing into entrepreneurship, then it is highly appreciable. The Report of projects and dissertations which are productive in methodologies should be disseminated through presentation and publication in social media, books, magazines and journals so as to spread the innovative ideas and methods to the broad public. KKET faculty members and students from various subject domains are doing extensive project work related to nature conservation, environmental pollution, soil and water analysis.

KKET is being offering various courses in Regulation 2021 related to biodiversity conservation, environmental safety and safeguard, environmental pollution and nature protection to the students and research scholars.

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14. Best practices followed on Green Campus initiatives in the Organization

1. It is observed that KKET is maintaining more than 65% of the green cover area after building construction as per the guidelines of World Green Building Council and Indian Green Building Council to provide a healthy environment and ecofriendly atmosphere to the stakeholders. It is calculated that the natural vegetation was 43.21% and planted vegetation was 0.021%.
2. KKET campus is located in near the Vellingiri Hills of the Western Ghats belonging to Tamil Nadu which provide pure atmosphere to the stakeholders under natural environment, topology, landscape and soil erosion. The campus is established without disturbing the natural vegetation along with the artificially created topography like pathways and parking areas.
3. KKET has created 'Herbal Gardern' for establishing a massive reforestation / afforestation planting programme in which a large number of trees and shrubs species were planted together with a minimum distance covering fruits, nuts and timber yielding plants are planted. It was established by following the method of Miyawaki that helps build dense, native forests and to restore the natural potential vegetation, landscape management and control soil erosion.
4. In view of floral biodiversity in KKET campus, a sum 126 species belonging to 76 Genera under 48 families covering trees, herbs, shrubs, climbers, lianas, twiners and lawns and 72 species belonging to Lichens, Pteridophytes, Bryophytes and Mycoflora like Mushrooms were recorded. It is observed that all the plants are growing profusely and showing healthier free from pests and diseases.
5. In view of faunal biodiversity in KKET campus, a total of 7 living Mammals species belonging to 4 Genera under three families, visiting Mammals about 6 species belonging to four Genera under three families, 12 species of birds, 12 species of Grasshoper, 5 species of Termites, 18 species of Amphians, 11 species of Reptiles, 43 species of Butterflies and 3 species Mosquitos were recorded.
6. KKET has established rainwater harvesting models, percolation pond and check dam to recharge the borewells by collecting rainwaters from the building roofs, open areas and playgrounds including unexplored areas which are channelized to flow of rainwaters to increase the ground water level.
7. The campus has a maximum number of more oxygen producing and carbon-di-oxide absorbing plants such as *Areca* Palm, Money plant, Neem tree, Arjun tree and Pongam trees including some of the shrub and herbal plants.
8. Department of Computer Science, Management, Commerce and Information Technology, KKET is being offering various courses in Regulation 2021 related to biodiversity conservation, environmental safety and safeguard, environmental pollution, natural disaster management and waste management and environmental impact assessment and green auditing to the students and research scholars.

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15. Recommendations for Greening

- The name board may be kept in each plant species in which the common name along with binomial name may be mentioned. The year of planting and economic importance with medicinal values if any may be mentioned in some plants so that the oldest as well as useful herbal plants may be identified in the campus.
- Honey Bee hives may be kept in the campus which is free from student's mobilization. Honeybees are natural pollinators helps to increase the yield potential of plants (flowers, fruits and vegetables) upto 33%.
- A complete data on the soil parameters such as pH, electrical conductivity, water holding capacity, total organic carbon, available nitrogen, exchangeable potassium, available phosphorus in the campus may be studied which may be useful for the cultivation of various native and wild type plant species.
- A complete data on the water quality parameters such as pH, TSS, BOD, COD, dissolved oxygen and dissolved carbon dioxide and macro and micro elements like iron, nickel, chromium, ferric and ferrous ion concentrations may be studied for which bore well, open well, corporations, municipal RO, Aquaquad, Millipore. Distilled water rain water and may be used. It may be analysed which may be useful for the plant growth as well as to the stakeholders.
- Vermicompost production may be increased substantially using tree leaf litter, kitchen wastes and biodegradable waste materials available in the campus. The vermicompost manure can be used for plant cultivation and the excess amount of vermicompost may be sold in the local market as consultation work.
- The matured trees may be subjected to do white wash upto 3 feet height with limestone and neem oil mix to prevent the pests and diseases attack.
- Automatic water irrigation systems like drip and sprinkler irrigation methods adopted may be extended in the entire green area of the campus which in turn are useful to reduce the operation costs under energy conservation policy.
- It is recommended to develop 'Green Campus Policy', 'Energy and Environment Policy' and 'Purchase Policy' for not allowing the non-degradable plastic covers during the paking of goods with respect to nature conservation and environmental protection.
- The Management has to take smart initiatives towards creating a Green campus in the areas of green computing and waste management. The desktop infrastructure is virtualized through VMW are virtualization technology.
- Eco club student chapters, forums, cells, etc. may be started to among the life science students from which a large number of programmes on nature conservation and environmental protection may be conducted to rural, tribal and urban people.

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16. Conclusion

In the three decades of service to higher education, KKET, Coimbatore, Tamil Nadu has made significant progression in teaching learning, research and consultancy, innovation and transfer of technology, community service and value education. KKET is a well-established State self supporting Institution in Tamil Nadu which imparts quality education to rural, tribal and urban people across the Country. This KKET is excellent in terms of academic activities and providing an eco-friendly atmosphere to the stakeholders. The KKET has taken enormous efforts to maintain green campus to the students, research scholars, staff members and parents in a sustainable manner which reflects the importance of the environment and stakeholders. It is conducting a large number of activities for the benefit of rural and tribal community people without disturbing the natural environment, topology, landscape management and vegetation. KKET is maintaining more than 65% of the green cover area after building construction along with 43.21% of natural vegetation and 0.021% planted vegetation.

The natural topography and very good landscape design without disturbing the natural vegetation are being maintained by the KKET. A maximum number of more oxygen producing and carbon-di-oxide absorbing plants are being maintained to provide pure atmosphere to the stakeholders. The installation of a rainwater harvesting system, percolation, ponds, check dam and drip irrigation system to conserve rainwater and ground water are noteworthy in the campus. KKET has created 'medicinal garden' for establishing a massive reforestation / afforestation planting programme in which a large number of trees and shrubs species were planted together with a minimum distance covering fruits, nuts and timber yielding plants are planted. The KKET has very good floral biodiversity with 126 flowering plant species belonging to 76 Genera under 48 families and 28 species of non-flowering plant species. Similarly, very good faunal biodiversity with 12 living and visiting Mammals belonging to 4 Genera under three families, 12 bird species, 12 Grasshopper species, 5 Termites species, 18 Amphians species, 11 Reptiles species, 43 Butterflies species and 3 Mosquitos species were recorded. This may lead to a prosperous future in the context of a significant Green campus and providing a sustainable environment to the stakeholders.

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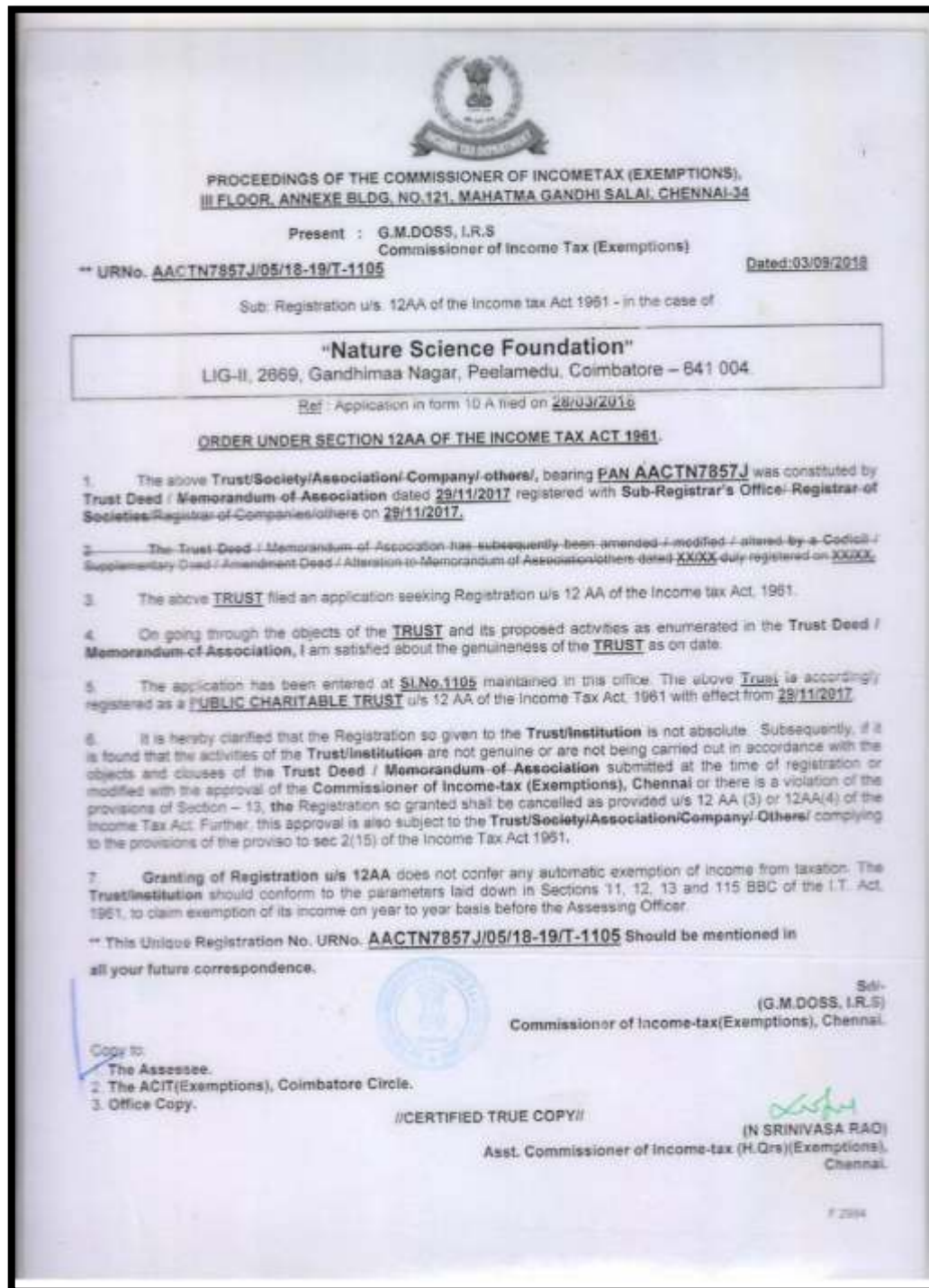
Certificates of Nature Science Foundation, Coimbatore, Tamil Nadu.

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2. 12A Certificate
3. 80G Certificate

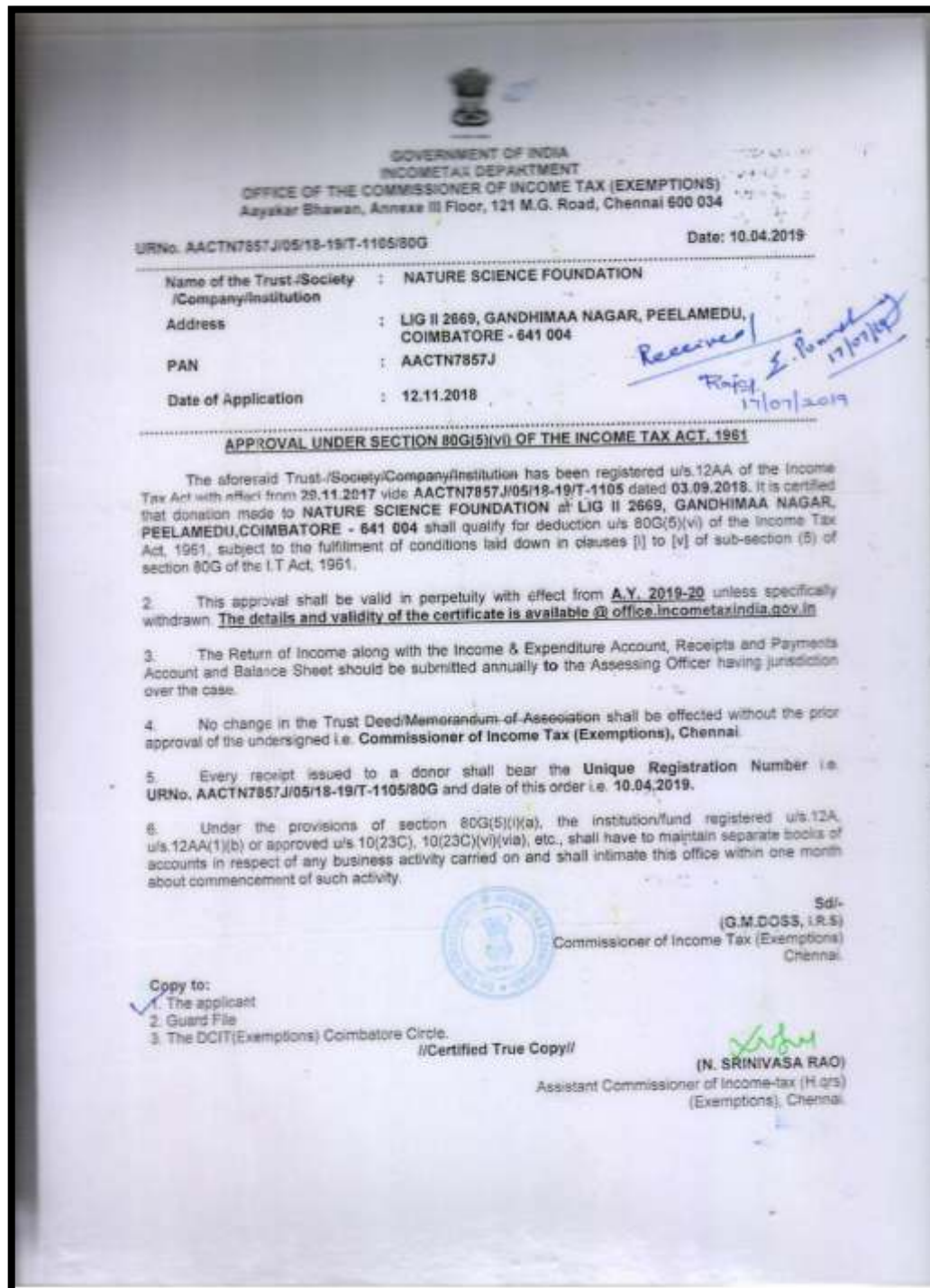
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Certificates of Green Campus Auditor

1. ISO Environment Management System (14001:2015) of Mrs. S. Rajalakshmi, Founder & Chairman of NSF.
2. ISO Environment Management System (14001:2015 TUV NORD) of Dr. A. Geethakarathi, NSF Environment Auditor.
3. Indian Green Building Council (IGBC AP) Accredited Professional of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
4. Associated Chambers of Commerce and Industry of India (ASSOCHAM), of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
5. Associated Chambers of Commerce and Industry of India (ASSOCHAM), of Er. Ashutosh Kumar Srivastava, Board of Directors (North Zone) of NSF.
6. Botanist and Subject Expert of Plant Taxonomy of Dr. D. Vinoth kumar, Joint Director of NSF.
7. Energy and Environment Engineering (EEE Auditor) of Er. B. Vijayalakshmi, Deputy Director of NSF.
8. Bureau of Energy Efficiency (BEE) of Dr. N. Balasubramanian, Energy Auditor of NSF.

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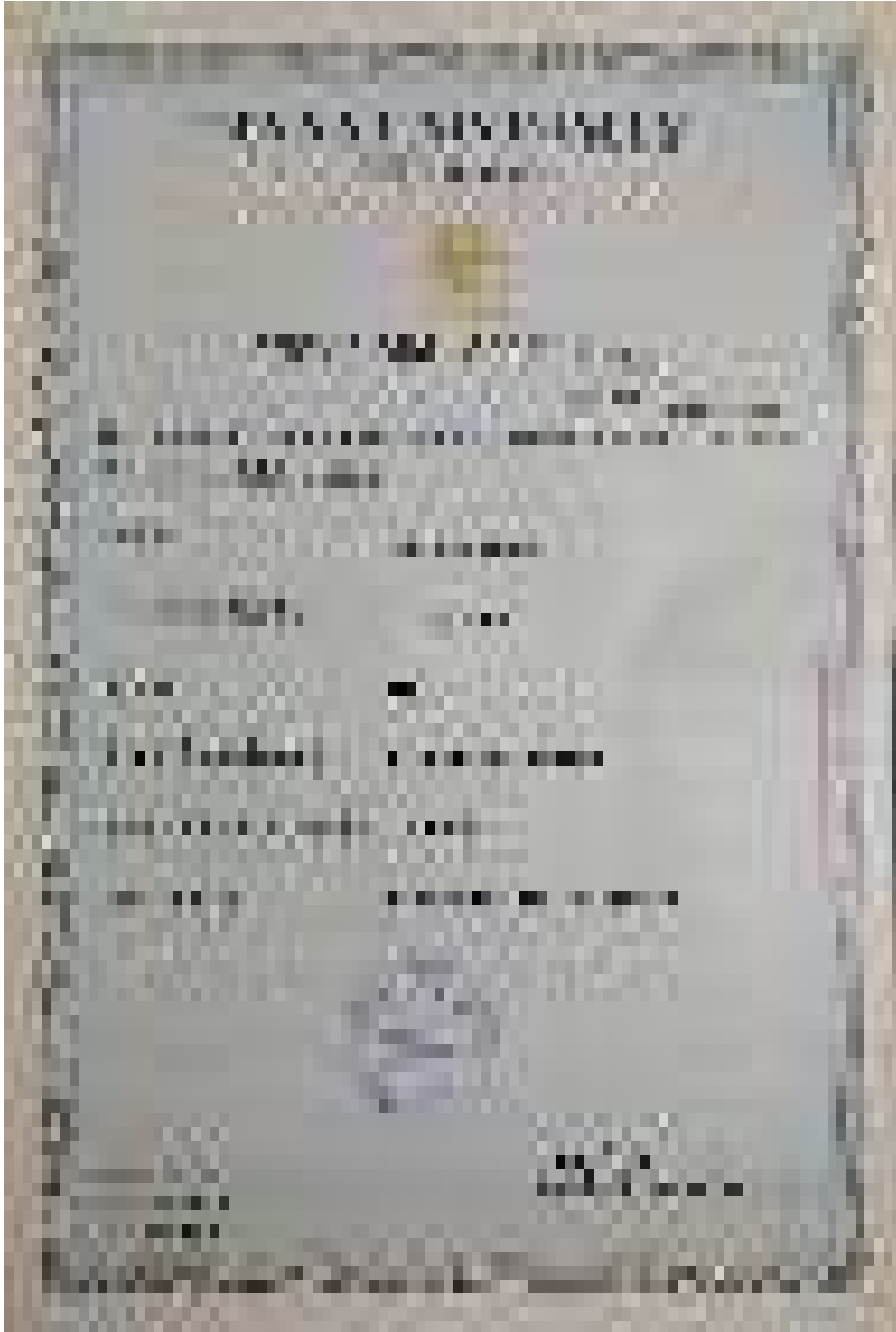


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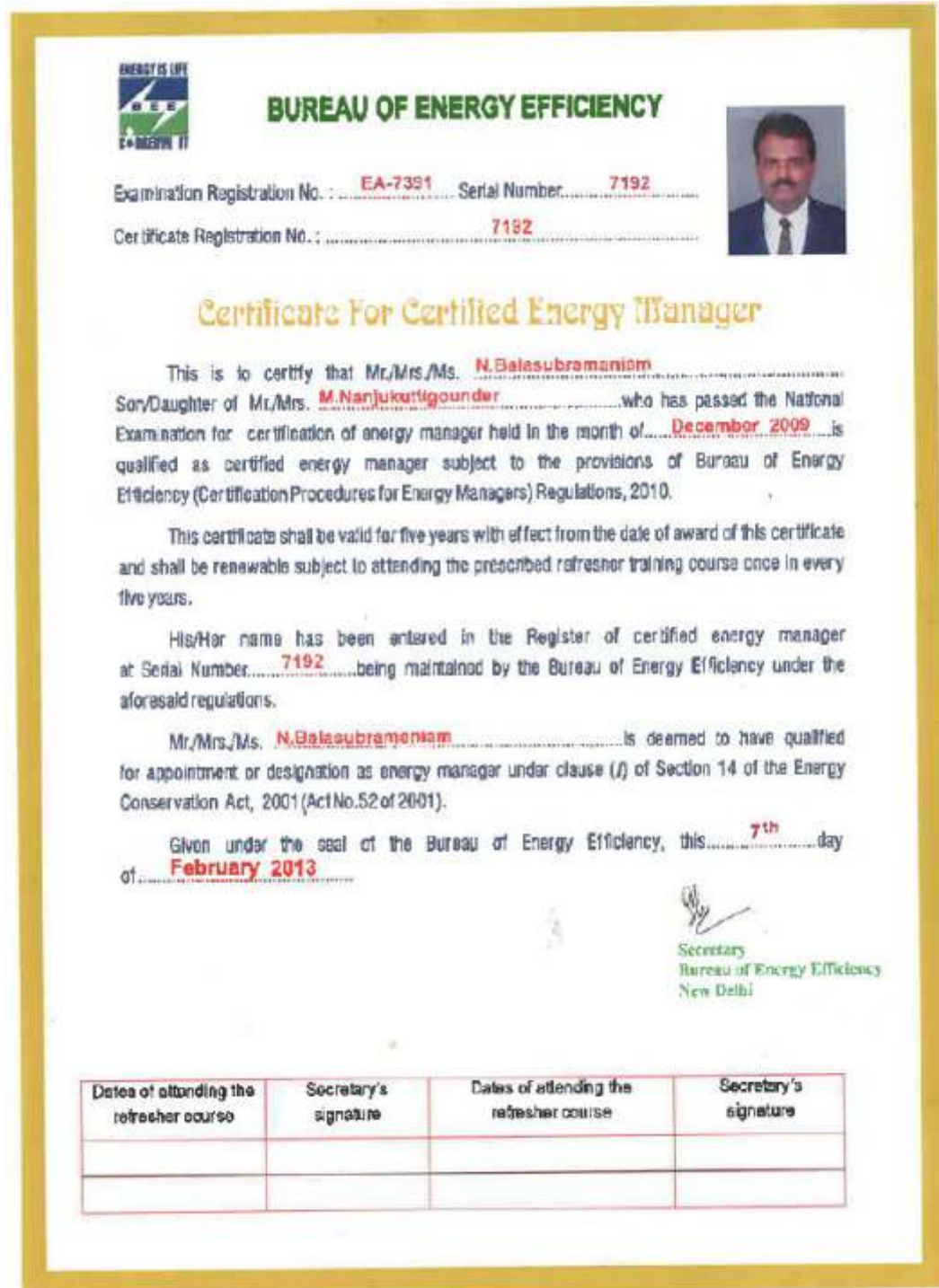


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Regn. No. EA-7391		Certificate No. 5093
National Productivity Council (National Certifying Agency)		
<u>PROVISIONAL CERTIFICATE</u>		
<p>This is to certify that Mr. / Ms. <u>N. Balasubramaniam</u> son / daughter of Mr. <u>M. Nanjukuttigounder</u> has passed the National Certification Examination for Energy Auditors held in December - 2009, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.</p> <p>He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.</p> <p>He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.</p> <p>This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.</p>		
Place : Chennai, India		 Controller of Examination
Date : 11 th February 2010		


15/11/2023
Principal

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Narasipuram, Coimbatore - 641 109.