

TECHNICAL REPORT OF GREEN CAMPUS AUDIT



Submitted to

T. K. MADHAVA MEMORIAL COLLEGE
ALAPPUZHA, KERALA, INDIA

Date of Audit :30.08.2022

Submitted by



NATURE SCIENCE FOUNDATION

(A Unique Research and Development Centre for Society Improvement)
[ISO QMS (9001:2015), EMS (14001:2015), OHSMS (45001:2018) &
EnMS (50001:2018) Certified and Ministry of MSME Registered Organization]

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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/planned to incur less energy, less water, less or no CO₂ emission and less or pollution free environment (Aparajita, 1995). Green Campus Audit is a tool to evaluate environment management system which is systematically executed to protect and preserve the environment. Green campus audit constitutes the environmental friendly practices and education combined to promote sustenance of green environment adopting user-friendly technology within the campus. It creates awareness on environmental ethics, resolves environmental issues and offers solutions to various social and economic needs (APHA, 2017). It strengthen 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; it is also useful in relation to biodiversity conservation, landscape management, irrigation/economic water utilisation and maintenance of natural topography and vegetation (Gowri and Harikrishnan, 2014, Aruninta *et al.*, 2017). The maintenance of an eco-friendly campus ensures a neat and clean environment. For the benefit of stakeholders, solid waste management, recycling of water, disposal of sewage and waste materials (electronic and biomedical wastes), ‘zero’ use of plastics, 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. Green campus audit helps the educational institutions/ industries to maintain eco-friendly environment, assures personal hygiene to various stakeholders and supports the nation; on the whole for the noble cause of environmental protection and nature conservation which in turn enhances the quality of life of 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 skills and offers a conducive learning environment to the students. Educational institutions are insisted by both Central and State Governments to offer eco-friendly atmosphere to the stakeholders. In addition, all the Educational institutions are asked to save the environment for future generations and to resolve the environmental problems (accumulating solid wastes and wastewaters/effluents and their careless disposal, enormous utility of plastics, uneconomical consumption of water, irresponsible in water harvesting and storage procedures, etc.) through Environmental Education. Implementing Swachh Bharath Abhiyan Scheme launched by the Indian Government thro’ the Educational institutions plays a major role in terms of giving neat and clean

environment to tribal, rural and urban people across the country, besides the regular and conventional activities carried out by NSS, NCC/Student Force, Nature club, Eco club, Science club, Fine Arts club, Flora and Fauna club, Youth 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 method whereby an organization's environmental performance is checked against its environmental strategies 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. The green campus audit processes are being undertaken by World / Indian Green Building Council (IGBC), Green Building Code and Green Ratings Systems (GBCRS), Green Rating for Integrated Habitat Assessment (GRIHA), Consideration of Indian Industry GreenCo Rating System (CII-GreenCo) and Associated Chambers of Commerce and Industry of India (ASSOCHAM) along with ISO EMS 14001:2015 criteria and the concept of Swachh Bharath Abhiyan under Clean India Mission

3. Green Campus and Environment Policy

Green campus and environment policy aims to provide an education and awareness in a clean and green environment to the stakeholders with regard to environmental compliance. Scope of the policy applies to all employees and students of the Institution/organisation to provide an ecofriendly atmosphere. Green Campus Policy dealt with cleanliness of the campus maintained through proper disposal of wastes and steps to be followed to recycle the biodegradable wastes and utilization of eco-friendly supplies to maintain the campus free from hazardous wastes/pollutants. The concept of eco-friendly culture is disseminated among the students as well as rural community through various awareness programmes. Attempts are made to minimise the energy usage and substitute the non-renewable energy sources with renewable energy sources. Head of the Organization, Departmental Heads and Senior Managers/ Management Representatives are responsible for monitoring the "Go Green" initiatives of the College/University and maintain a clean/green campus while each and every individuals of the organisation should adhere to the policy.

4. Environment Friendly Campus

As stated earlier, Organization is liable to provide an eco-friendly atmosphere along with good drinking water facility to all the stakeholders (students and staff members). Manuring the cultivated plants/grown within the campus may applied with organic manure, cow dung, farmyard manure and vermicompost instead of using chemical fertilizers. All non-compostable and single-use disposable plastic items, plastic utensils, plastic straws and stirrers should be avoided. Demonstration/awareness programme on establishing plastic-free environment and utility of organic alternatives for all incoming and current students, staff and faculty should be organised. Reduction

of use of papers alternated with e-services, e-circulars, etc. and proper disposal of wastes, recycling and suitable waste management system should be considered to establish environment friendly campus.

5. Aims and Objectives of Green Campus Audit

- To recognise the initiatives taken towards establishing the green campus in terms of gardening.
- To grow a large number of oxygen releasing and carbon dioxide assimilating plants in the campus to give a pure atmosphere to the stakeholders.
- 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 ensure proper utilization of resources available in the surrounding areas towards future prosperity of the humanity.
- To fix a couple of norms for disposal of all varieties 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. Importance of Green Auditing

The Management of the Organization (Auditee) should be exposed their inherent commitment towards making ecofriendly atmosphere through the green auditing and ready to encourage/follow all types of green activities. They should promote all kinds of green activities such as conduct of environment awareness programmes, in-campus farming, planting trees and maintenance of greening, irrigation, use of biofertilizers and avoidance of chemical fertilizers and agrochemicals, etc., prior to and after the green campus auditing (Suwartha and Sari, 2013). The administrative authorities should formulate 'Green and Environment Policies' based on technical report of green campus auditing. A clean and healthy environment will enhance an effective teaching/learning process and creates a favorable learning green environment to the scholars. They should create the awareness on the importance of greenish initiatives through environmental education among the student members and research scholars. Green Audit is the most effective, ecological approach to manage environmental complications.

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 huge number of trees which is a duty of each and every individual who are the part of economical, financial, social, and 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 beneficial effects in order to save planet by means of 'Go green concept' which in turn support the institution to set environmental models ('icon') for the community. Green audit is a professional and useful measure for an Organization to determine how and where they are retaining the campus eco-friendly manner. It can

also be used to implement the alleviation measures at win-win situation for the stakeholders and the planet. It provides an opportunity to the stakeholders for the development of ownership, personal and social responsibility.

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 based on the audit report. 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 in accordance with prevailing rules issued by the government/local authorities
- Assigning the roles and responsibilities to the Environmental Engineer and Agriculture Staff who are all responsible 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
- 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 releasing and carbon dioxide assimilating 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.
- 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/Student Force 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.
- High degree of resource management offers the basis for improved sustainable and creation of plastic free campus to evolve health consciousness among the stakeholders.
- Impart of knowledge on environment through systematic management approach and improving environmentally friendly standards by creating 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.

8. About the Organization

8.1. T. K. Madhava Memorial College

Madhavan dedicated his life to the cause of the oppressed people. In the year 1964, the college is noted as a temple of learning established through the efforts of Karthikappally, Karunagappally and Mavelikkara SNDP Unions. About 14 Sree Narayana Colleges were established throughout the length and breadth of Kerala that resembles the living monuments of the great guru. During this last few decades, the institution has concurred a niche for itself among the illustrious cluster of institutions during this last 4 decades.

The institution has been a pioneering institution of higher education in Alappuzha district after being named by the freedom fighter and social reformer T. K. Madhavan. In maintaining the quality of education, the institution is in forefront and also reinforcing the rural people of backward and marginalized community. Alumni and faculty of the institution with regard to political, literacy, cultural, scientific and entrepreneurial firmaments have made appreciable contributions, since its inception. This also includes the lead contributions of poet and the lyricist Anil Panachooran, renowned Malayalam actor Ashokan, Pro Vice Chancellor of Sree Narayanaguru Open University Prof (Dr.) S. V. Sudheer to the institution.

Mission and Vision

T. K. Madhava Memorial College, upholding the ideology of the great saint & social reformer, Sree Narayana Guru, ‘Enlightenment through Education’, envisages accessible, transformative and quality education, to equip students with knowledge and skills in their chosen stream, inculcate values, provide opportunities for students to realize their full potential and thus shape them into responsible citizens. Their mission is to prepare young minds to imbibe knowledge, skills and sensitivity. Igniting the scientific and rational thinking among youth and elevating them socially and economically backward community through quality and inclusive education. The institution makes sure gender equality and transformative education and also imparts quality education in science, humanities and commerce by integrating traditional and innovative teaching and learning practices.

For instilling the philosophy and vision of the quintessential leader, T. K. Madhavan, created a platform for students for exploring their creative potential and nurturing the spirit of critical thinking. T. K. Madhava memorial college foster conceptual understanding and outcome based education at par with New Education Policy. The institution also equips students and teachers with the skills needed to adapt better to the changing global scenario. Students are been encouraged in value-based, integrated and scholastic thinking practice for transforming towards a liberated society. T. K. M. memorial college is following the core values in the form of STEER system which comprises of Skill & Strength, Truth & Trust, Equality & Ethics, Endurance & Empowerment, Research & Renovation.

8.2. About Nature Science Foundation (NSF)

NSF is an ISO QMS (9001:2015), EMS (14001:2015), OHSMS (45001:2018) & EnMS (50001:2018) Certified and registered with Ministry of Micro, Small and

Medium Enterprise (MSME), Government of India Organization functioning energetically towards the noble cause of nature conservation and environmental protection. NSF is managed by a board of trustees of NSF Public Charitable Trust under the TN Societies registration Act 1975 (TN Act 27 of 1975) on 29th November, 2017 at Peelamedu, Coimbatore - 641 004, Tamil Nadu, India with Certificate of Registration No. 114 / 2017. In addition, NSF has 12AA, 80G and Form 10AC certificates for income tax exemption and implanting various Government schemes. The main motto of the NSF is to “Save the Nature to Save the Future” and “Go Green to Save the Planet”. NSF Branch Offices are also functioning effectively at Gorakhpur, Uttar Pradesh and Faridabad, Haryana, India to adopt the ‘Go Green Concept’ in a big way. NSF family is wide spread across India with over 115 state-wise Lead auditors to conduct Green and Environment Audits.

NSF is functioning strenuously to conduct different awareness programmes and implement various schemes to public and school / college students towards the noble cause of nature protection. Some of the programmes are also being organized for the benefit of tribal communities to create the supply chain for biodiversity conservation studies. The objectives along with vision and mission are illustrated to promote educational and environmental awareness programmes through social activities for enhancing the quality of life and to conserve nature from environmental pollutants using traditional and modern technologies for sustainable land management. NSF is educating the tribal community children through social service and towards the upliftment of tribes as a whole and make them as entrepreneurs.

International Eco Club Student Chapter (IECSC) has been established for Student volunteers and faculty members are encouraged to conduct National and International events, Student Technical Symposium, Distinguished lecture programme, Environment day celebration, Ozone day celebration, Project model exhibition, Awareness programmes on Environmental pollution, Biodiversity and Natural resources conservation and etc. with the financial support of the Foundation. NSF is being released ‘Magazine’ and ‘Newsletter’ biannually to share the information about Environmental awareness programmes on biodiversity conservation, seminar on soil conservation, water management and solid waste management, restoration and afforestation programmes in Western Ghats of southern India.

In order to encourage the students, members of faculty, academicians, scientists, entrepreneurs and industrial experts those who are involving in nature protection and biodiversity conservation studies across the world, NSF tributes the deserved meritorious candidates with various awards and honours such as ‘Best Faculty Award’, ‘Best Women Faculty’, ‘Best Scientist Award’, ‘Best Student Award’, ‘Best Research Scholar Award’, ‘Best Social Worker Award’, ‘Young Scientist Award’, ‘Life-Time Achievement Award’ and ‘Fellow of NSF’. These award and honours will be given to the deserved meritorious candidates during the ‘Annual Meet and Award Distribution Ceremony’ which will be conducted every year during the first week of January.

NSF has introduced various types of Audits such as ‘Eco Audit’, ‘Green Audit’, ‘Energy Audit’, ‘Hygienic Audit’ Water & Soil Audit, Plastic Waste Management

Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit, Academic & Administrative Audits including ISO certification process to Academic Institutions, R&D Organizations and Industries towards the accreditation process as well as maintaining a hygienic eco-friendly environment to the stakeholders in their campus. All audits will be conducted as per the Checklist prepared by the NSF ISO Criteria and in compliance with Government Law and Environmental Legislations including World / Indian Green Building Council and the concept of Swachh Bharath Abhiyan under Clean India Mission. Green campus and Environment Policy, Purchase Policy, Energy Policy, MoU, International Eco Club student Chapter.

Audit processes are being conducted through the certified Auditors as per the following by the NSF

Audit	Certified Auditors	Certified Auditors
Green Audit	<ul style="list-style-type: none"> • IGBC - Indian Green Building Council • GBCRS - Green Building Code and Green Ratings Systems • GRIHA – Green Rating for Integrated Habitat Assessment 	<ul style="list-style-type: none"> ➤ Mrs. S. Rajalakshmi ➤ Dr. R. Mary Josephine ➤ Dr. B. Mythili Gnanamangai ➤ Er. Ashutosh Kumar Srivastava ➤ Er. N. Shanmugapriyan
Energy Audit	<ul style="list-style-type: none"> • BEE - Bureau of Energy Efficiency • LEED - Leadership in Energy and Environmental Design • CII-GreenCo – GreenCo Rating System Felicitator 	<ul style="list-style-type: none"> ➤ Er. D. Dinesh kumar ➤ Er. N. Shanmugapriyan ➤ Dr. N. Balasubramaniam ➤ Dr. P. Thirumoorthi ➤ Dr. G. Muruganath
Environment Audit	<ul style="list-style-type: none"> • IGBC -Indian Green Building Council • ASSOCHAM - Associated Chambers of Commerce and Industry of India • FSRS – Fire Safety & Rescue Services 	<ul style="list-style-type: none"> ➤ Mrs. S. Rajalakshmi ➤ Dr. A. Geetha Karthi ➤ Dr. R. Mary Josephine ➤ Dr. B. Mythili Gnanamangai ➤ Er. Ashutosh Kumar Srivastava ➤ Er. N. Shanmugapriyan
Hygiene Audit	<ul style="list-style-type: none"> • FSMS – Food Safety Management System & • Occupational Safety & Health (ISO 22000:2018) • SBICM - Swatch Bharath under India 	<ul style="list-style-type: none"> ➤ Mrs. Gaanaappriya Mohan ➤ Er. Ashutosh Kumar Srivastava ➤ Dr. R, Sudhakaran ➤ Dr. N. Saranya

	Clean Mission	
Waste Management Audits	<ul style="list-style-type: none"> Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit as per the Checklist of NSF 	<ul style="list-style-type: none"> Mrs. Gaanaappriya Mohan Er. Ashutosh Kumar Srivastava Dr. R, Sudhakaran Er. N. Shanmugapriyan
ISO Certification	QMS (9001:2015), EMS (14001:2015), OHS (45001: 2018), ISMS (27001:2018), FSMS (22000:2018), QMSMD (13485: 2016), EnMS (50001: 2018)	<ul style="list-style-type: none"> Er. Ashutosh Kumar Srivastava Mrs. S. Rajalakshmi Dr. A. Geetha Karthi Mrs. Gaanaappriya Mohan Dr. R. Mary Josephine

Table 1. T. K. Madhava Memorial College facility details

S.No.	Details of Area	Total area
1.	Total Campus area	25 acres
2.	Total Built up area	16235
3.	Covered Car parking area	5600 sq.ft
4.	Air-conditioned area	16214 Sq. ft
5.	Non-Airconditioned area	1253 Sq. ft
6.	Gross Floor area	5 acres
7.	Public area	16356 Sq. ft
8.	Service area	12481 Sq. ft
9.	Forest vegetation	18.5%
10.	Planted vegetation	70.5%

9. Audit Details

Date / Day of Audit	: 30.08.2022
Venue of Audit	: T. K. Madhava Memorial College, Alappuzha-690 513, Kerala, India.
Audited by	: Nature Science Foundation, Coimbatore, Tamil Nadu, India.
Audit type	: Green Campus Audit
Name of Auditing Chairman	: Mrs. S. Rajalakshmi Jayaseelan, Chairman of NSF & ISO QMS, EMS, OHSMS, EnMS Auditor.
Name of IGBC AP Auditor	: Dr. B. Mythili Gnanamangai, Vice Chairman of NSF & Indian Green Building Council Accredited Professional.
Name of Lead Green Auditor	: Dr. R. Mary Josephine, Plant Taxonomist & Principal, St. Joseph College for Women, Tiruppur, TN.

Name of Subject Expert-I	: Dr. D. Vinoth Kumar Joint Director of NSF & ISO EnMS Auditor.
Name of Subject Expert-II	: Mr. B.S.C. Naveen Kumar, Senior Faculty, Mahatma Gandhi National Council of Rural Education, Ministry of Higher Education, Hyderabad.
Name of Subject Expert-III	: Er. D. Dinesh Kumar, Certified Lead Auditor, IGBC, ASSOCHEM, GRIHA & LEED
Name of the Energy Auditor	: Dr. N. Balasubramanian, Certified Bureau of Energy Efficiency Auditor of NSF.
Name of Eco & Green Officer	: Ms. R.S. Thulaja, Environment, Energy & 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. 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, 2018).

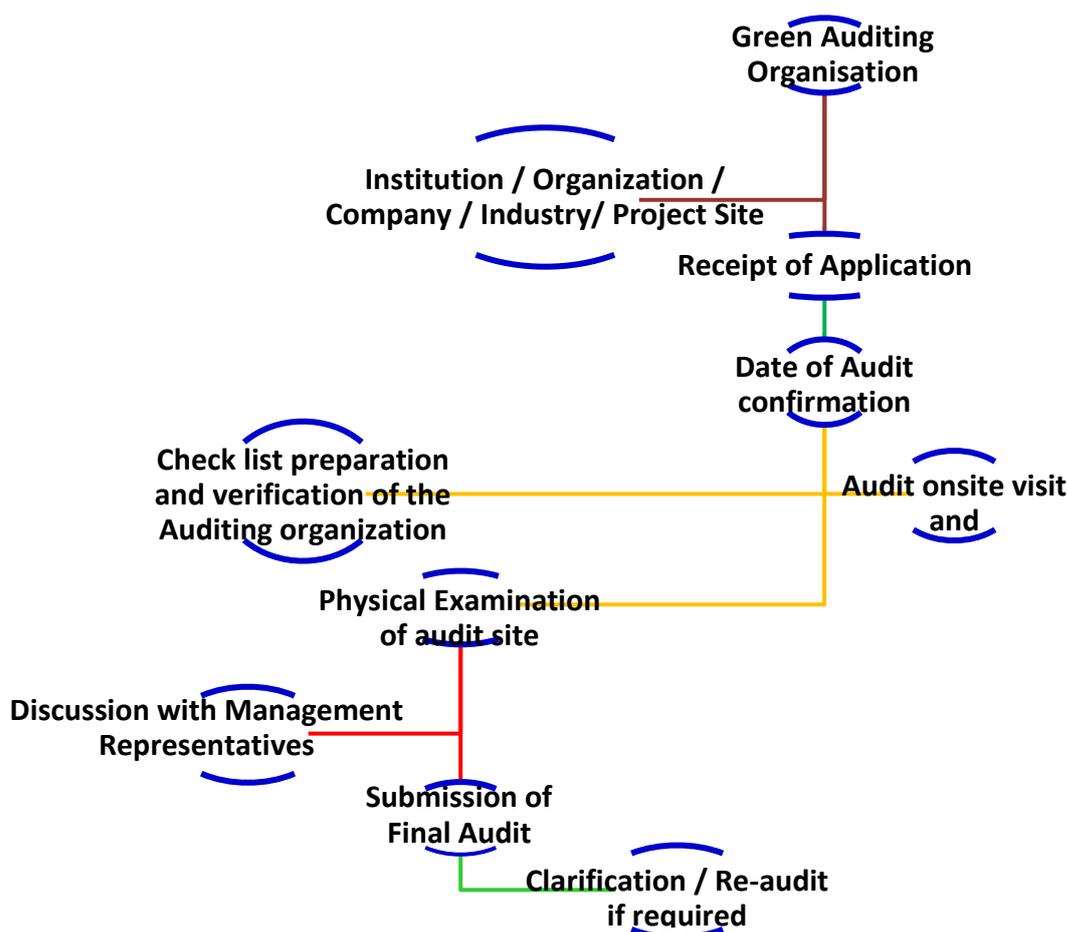
Green campus is not intended for the self-sustainability of the building alone, it also involves in propagation of the green campus initiatives so as to be adopted by any individuals and organization at a minimum cost. Green campus audit has been conducted as per the checklist of Nature Science Foundation, 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 (Staniskis and Katiliute, 2016, SCSR, 2018). 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 thriving within 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, drip and sprinkler irrigation methods and use of recycled water for irrigation purpose or any other purpose in the campus area were noted.

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 (Lauder *et al.*, 2015; Brindusa *et al.*, 2007). 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 (Leal Filho *et al.*, 2015). 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 were assessed. In addition, supporting activities of the scholars and staff with regard to “Vision and Mission” of the greenery activities of the Organization is also evaluated.



Flow-chart of Green Campus Audit Procedures

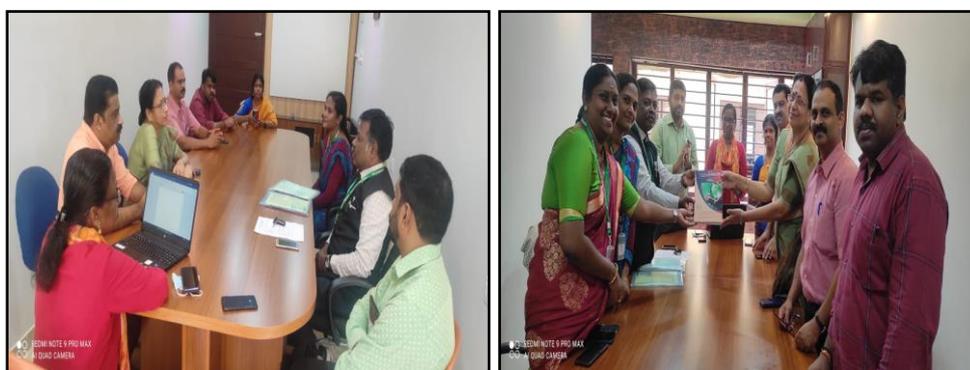
10.1. Onsite Green Campus Audit activities

1. Opening meeting is the first step between the audit team and auditee along the Management Representatives where the purpose of the audit, procedures to be adopted for the conduct of the audit, verification of the documents and the time schedules were discussed, in brief.
2. Followed by opening meeting, onsite inspection will be conducted which is the second step in the audit where the Audit team members visited different sites in the T. K. Madhava Memorial College campus and required 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 the T. K. Madhava Memorial College 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. The assessment reveals the strengths and weaknesses of the Auditee's Management controls and risks associated with their failure in creating Green campus facilities.
5. Collecting audit proofs *ie*, data collection and information from the auditee as per the audit protocol were carried out.

6. An exit meeting was conducted to describe the findings of the audit with Management Representatives and staff members along with the audit team in brief.

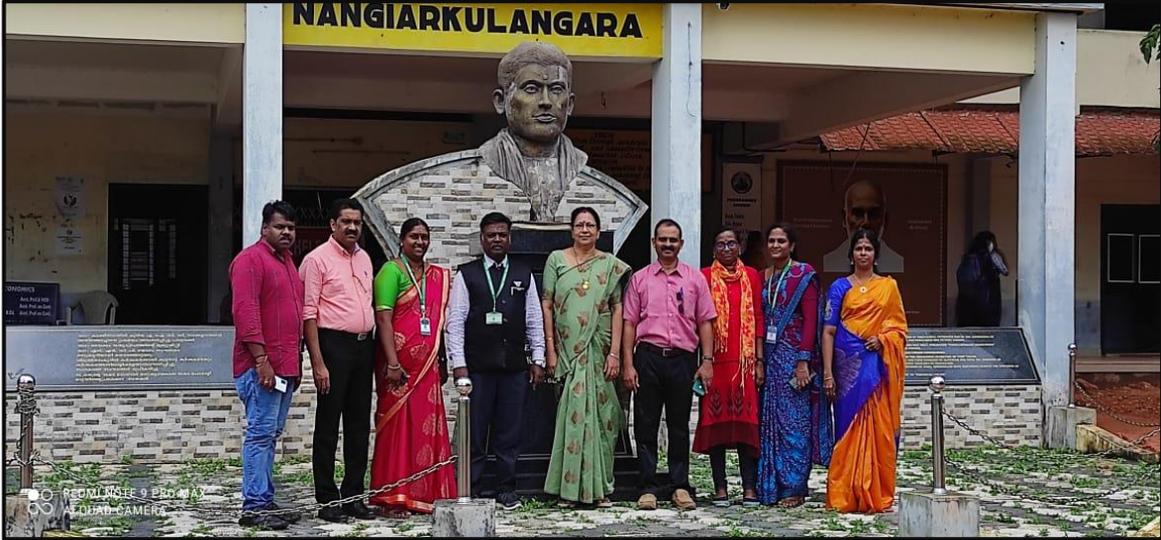
10.2. Pre-Audit stage activities

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 a chance to emphasize the scope and objectives of the audit and discussions held on the feasibilities associated with the audit (Marrone *et al.*, 2018). Pre-audit stage activities are an essential prerequisite for the green audit to meet the auditee and to gather information about the campus and required documents were collected directly from the Organization before the start of the audit processes (Fachrudin *et al.*, 2019). 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.



Opening meeting with the Principal and Management Responsibilities of the T. K. Madhava Memorial College and Audit Team of the Nature Science Foundation

Energy and Environment Audit Activity at the T. K. Madhava Memorial College by the NSF Audit team



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 concentrate on the efficient use of energy and water; Minimize waste generation or pollution and also improve the economic efficiency. Green campus audit process may be undertaken at frequent intervals and their results can demonstrate 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 (Choy and Karudan, 2016).

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 releasing and carbon dioxide assimilating plants, landscape management, topology, vegetation, soil erosion control, carbon footprint due to use of vehicles, electricity and fossil fuels (León-Fernández and Domínguez-Vilches, 2015). 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, persons needs special attention and or maternity care, security, safety and health infrastructure facilities for stakeholder's wellbeing (Nunes *et al.*, 2018).

10.4. Flora and Fauna diversity of study area



T. K. Madhava Memorial College was surrounded with well developed lawns at different sites, planted and maintained with variety of flowering and non-flowering plants. Constructing and maintaining mini aquariums with diverse variety of fish species in the campus is encouraged in the near future. The Campus is maintained in eco-friendly manner with appropriate number of trees, plantation was put forth by kitchen master chefs of the respective institution in the available vacant places near the hostel and in any unoccupied spaces. Proper utilization of the yield from those mini

farms for cooking in the hostel mess and canteen was carried out. Altogether, from this statement the campus provide the stakeholders with neat, clean and green environment. Study/documentation of biodiversity provides a useful measurement of the quality of environment. The ecological studies are the most important aspects of environment concerned, in view of the consideration of environmental quality and natural flora and fauna conservation.

With respect to the flora and fauna diversity studies, topography data of T. K. Madhava Memorial College campus within the area are collected. Topographic analysis are concerned with the collection of latitude and longitude measurements. Geology and condition of soil are monitored with the help of laboratory analysis for the campus under study. Total area of the campus are measured individually surveyed for the geological studies. Soil edaphic and environmental parameters are analyzed by laboratory procedures and tabulated as follows.

10.4.1. Topography

The T. K. Madhava Memorial College topographic studies were reported for the following campuses as follows,

Topography	Campus data
Longitude	76.46482° E
Latitude	9.26458° N.

10.4.2. Geology and Soil condition

With an ambient climatic condition, T. K. Madhava Memorial College located at Nangiarkulangara, Post, Haripad, Alappuzha District, Kerala. The type of soil that can be seen around the outskirts of Alappuzha is sandy, peaty, alluvial soil and laterite type. Alappuzha is the only district in Kerala having no area under forest cover with a diverse topography. It is surrounded by a sandy strip of land intercepted by lagoons, rivers and canals. There are neither mountains nor hills in the district except some scattered hillocks lying between Bharanikkavu and Chengannur blocks in the eastern portion of the district. 80% of the district lies in coastal region and the rest in midland region, with a contiguous long coastline of 82 Km. Water bodies constitute 13% of the district and Kuttanad area lies below sea level.

10.4.3. Climatic conditions

T. K. Madhava Memorial College campus season varies from temperate to humid condition. The average monthly temperature of the region is recorded as 25°C. During winter seasons we can enjoy a pleasant climate with a temperature of 20-32°C. the dry season is partly cloudy and it is hot and oppressive around the year. The month of April has an average maximum temperature of 34°C and is the warmest month in the year. January is observed as the coldest month with an average maximum temperature of 29°C. Rainfalls throughout the year completely within the location of the institution and also in the district of Alappuzha.

The clouds are seen clear around November and lasts for 4.8 months and ends around April. In February, the clouds are clearer and more referred as the clearest month of the year. Precipitation of the district where the institution is located changes throughout the year. The peak probability of 68% precipitation is observed on June

month of every year. Among the year June is the wettest month with 616mm of rainfall whereas January is the driest month with 18mm of rainfall.

Unlike temperature conditions which typically varies significantly between night and day, dew point tends to change more slowly, so while the temperature may drop at night, a muggy day is typically followed by a muggy night. Lower dew points feel to be drier whereas higher dew points feel to be more humid.

The length of the day does not vary substantially over the course of the year, staying within 40 minutes of 12 hours throughout. The perceived humidity level is measured by the percentage of time in which the humidity comfort level is muggy, oppressive, or miserable, does not vary significantly over the course of the year, staying within 3% of 97% throughout. The average hourly wind speed in Alleppey experiences significant seasonal variation over the course of the year. The windier part of the year lasts for 5.4 months, from April to October, with average wind speeds of more than 8.5 miles per hour. The windiest month of the year in Alleppey is June, with an average hourly wind speed of 12.1 miles per hour. The calmer time of year lasts for 6.7 months, from October to April. Similarly, the calmest month of the year in Alleppey is January, with an average hourly wind speed of 4.9 miles per hour.

The average water temperature experiences some seasonal variation over the course of the year. The time of year with warmer water lasts for 2.5 months, from March to May, with an average temperature above 85°F. The month of the year in Alleppey with the warmest water is April, with an average temperature of 86°F. The time of year with cooler water lasts for 2.2 months, from July to September, with an average temperature below 81°F. The month of the year in Alleppey with the coolest water is August, with an average temperature of 80°F.

Table 2. Soil edaphic and environmental parameters of the T. K. Madhava Memorial College Campus

S.No	Details of Parameters	Data collected
Soil edaphic parameters		
1.	Soil pH	4.9 to 8.7
2.	Soil types	Red soil
3.	Total organic carbon	5.63
4.	Electrical conductivity	0.17 to 1.0
5.	Water holding capacity	41.2%
6.	Total Nitrogen	3793ppm
7.	Available Phosphorous	15.16ppm
8.	Exchangeable Potassium	24.31ppm
Environmental parameters		
1.	Minimum Temperature	24.52°C
2.	Maximum Temperature	34.16°C
3.	Minimum Relative humidity	46.7%
4.	Maximum Relative humidity	75.45%
5.	Annual Average Rainfall	11.43 Cm
6.	Annual Average Sunshine	11.9 Hrs/day
7.	Wind speed	24.3 Km/Hr

11. Identification of Plant Species

11.1. Identification of Flowering Plant Species

Various vascular plant species were collected across the T. K. Madhava Memorial College campus and subjected to botanical identification (botanical name, family, habitat, and economic importance) and anthropogenic disturbances to the natural vegetation in campus. Plants were freshly collected and their digital photographs were also taken. The collected plant specimens have been identified using taxonomic literatures (Gamble and Fischer, 1972; 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 (BSI), Southern Circle, Coimbatore, Tamil Nadu, India.

11.2. Identification of Non-Flowering Plant Species

11.2.1. Lichen Identification

Lichen specimens were collected from the T. K. Madhava Memorial College campus and then identified based on the lichen identification key of Awasthi (2007). Representative lichen specimens were identified based on thalli morphology 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). In the present study, Anatomy of the thallus were carried out in order to document micro morphological features 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. 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 defined 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.

11.2.3. Identification of Algae Genera

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. Algae 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 adopt diverse life cycles, and by size, they range from microscopic *Micromonas* to giant kelps that reach 60 metres (200 feet) in length. Their photosynthetic pigments

highly varied when compared to that of higher plants; their cells have features not found among plants and animals. In addition to their ecological roles as oxygen producers, they serve as 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. They lack specialized multicellular reproductive structures of plants, but they always contain fertile gamete-generating 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.

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 behaviour 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 analyses 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 depend variables such as biotic and biotic factors as the independent variable (Jayson and Mathew, 2000).

Reptiles and Amphibians are identified based on colourtion, 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 (Beebee and Griffiths, 2000).

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 releasing and Carbon dioxide assimilating 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/Student Force 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. Table 3. Qualitative Measurements of Green Auditing

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 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 (45L/P/C/D)	✓		
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/Student Force, 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	✓		
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.			NA
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. Table 4. Quantitative Measurements of Green Auditing

S.No.	Details of Plant and animal species	Numbers / Percentage
1.	Total number of Flowering plant species inside the Campus	62 species belonging to 29 Genera under 18 families
2.	Total number of Non-Flowering plant species inside the Campus	8 species belonging to Lichens, Pteridophytes, Bryophytes and Mycoflora
3.	Total number of living Mammals inside the Campus	6 such as Cats, Mice and Dog
4.	Total number of visiting Mammals inside the Campus	4 Species belonging Rabbit, Squirrel and Monkey
5.	Total number of living Birds inside the Campus	14 species belonging Common Myna, House

		Sparrow, King- crow, House Crow, Jungle Babbler, Honey bird
6.	Total number of visiting Birds inside the Campus	7 species belonging Mangrove heron, Common Wood shrike, Peacock.
7.	Total number of Aquarium	-
8.	Total number of Aquatic (hydrophytes) plant species	02
9.	Total number of Grasshopper and Termites	Grasshopper: 3 species Termites: 2 species
10.	Total number of Amphibians and Reptiles	Amphibians: 4 species Reptiles: 4 species
11.	Total number of Butterflies and Mosquitos	Butterflies: 13 species Mosquitos: 03 species
12.	Percentage of Forest Vegetation	23%
13.	Percentage of Planted Vegetation	68%
14.	Percentage of Water consumption to total human population	2545 litres
15.	Percentage of Water consumption to total flora and fauna	2982
16.	Per capita water consumption per day	4.6 lit/day

13.3 Flora and Fauna diversity in the T. K. Madhava Memorial College Campus

13.3.1. Flora diversity in the T. K. Madhava Memorial College Campus

13.3.1.1. Flowering plants diversity in the T. K. Madhava Memorial College 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 dioxide. 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 the T. K. Madhava Memorial College campus has more than 42-51% of wild, 67-75% native plant species and the other 20-30% plant species are ornamental in nature coming under the planted vegetation. Native plant traits promote the indigenous fauna at the site area. Hence, the accountancy of 40% of the wild traits are leveraged for the native animals and birds. The most probable natural vegetation of T. K. Madhava Memorial College campus is the semi evergreen forest type. The remnants of this past vegetation are found in the campus.

The most plants recorded are *Azadirachta indica* A. Juss., *Tamarindus indica*, *Pongamia pinnata*, *Cassia fistula*, *Phyllanthus emblica* and *Mangifera indica* which are dominant trees species characteristic to the vegetation within the campus. Some of the shrub species like *Nerium oleander* L., *Nerium indicum* Mill, *Punica granatum* are also

rather common in the campus.

Ground flora is comparatively sparse, but fairly rich in undistributed areas. Some of the common weeds like *is* found to be predominant. Species such as *Cynodon dactylon*, *Catharanthus roseus*, *Euphorbia hirta* L., are some common herbs in the campus.

Certain common climbers found among the shrubs are *Anisomeles malabarica*, *Abutilon indicum* L., *Adhatoda vasica*, *Cardiospermum halicacabum*, *Coccinia grandis* L., *Citrullus landaus* (Thumb.), *Toddalia asiatica* L., and *Tinospora cordifolia* (wild.),.

This campus is rich in grass species like *Apluda mutica*, *Andropogon pumilis*, *Cenchrus ciliaris*, *Commelina benghalensis* L., *Asparagus racemosus* Wild., and *Rottboellia cochinchinensis* (Lour.),.

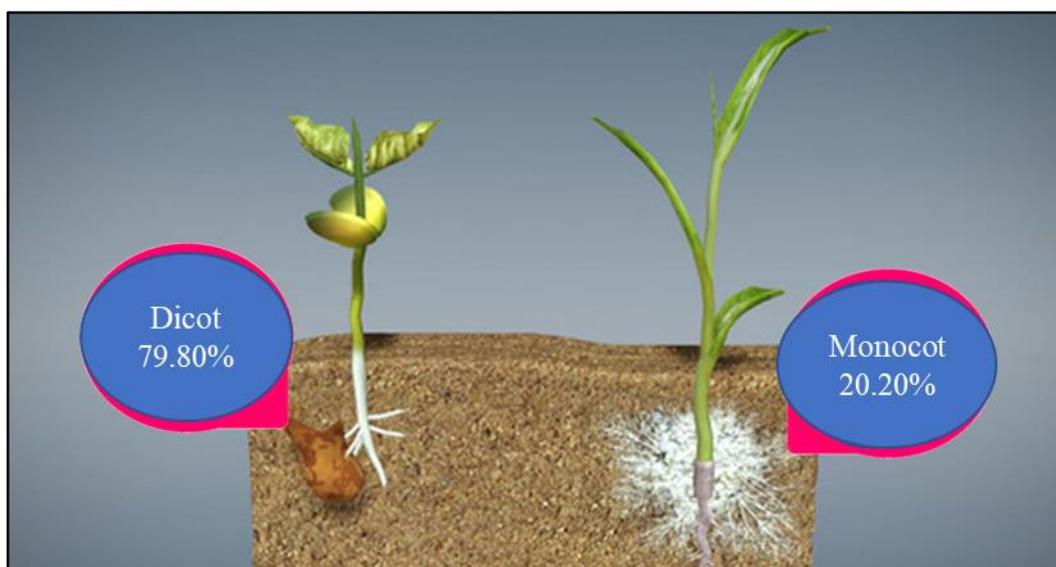
Most of the species found are common in the campus, some of the species *Bothriochloa compressa* (Hook.F.), *Chloris bournei* Rang & Tadul., *Hybanthus*, *Cucumis dipsaceus* Ehrenb, and *Caralluma bicolor* Ramach., is the rare species. Some endemic grass species like *Panicum psilopodium* Trin., *Perotis indica* (L.) Kuntze and *Andropogon pumilus* Roxb., are also occurring in the campus. Number of above species decreased in number and a few face the danger of going extinct due to anthropogenic activities (regular clearing and construction activities). Hence in terms of conserving the available floral biodiversity, it is pertinent to set up a botanical garden within the campus and cultivate them while protect the ones that grow naturally on the grounds upon the vegetation maintenance.

Invasive species

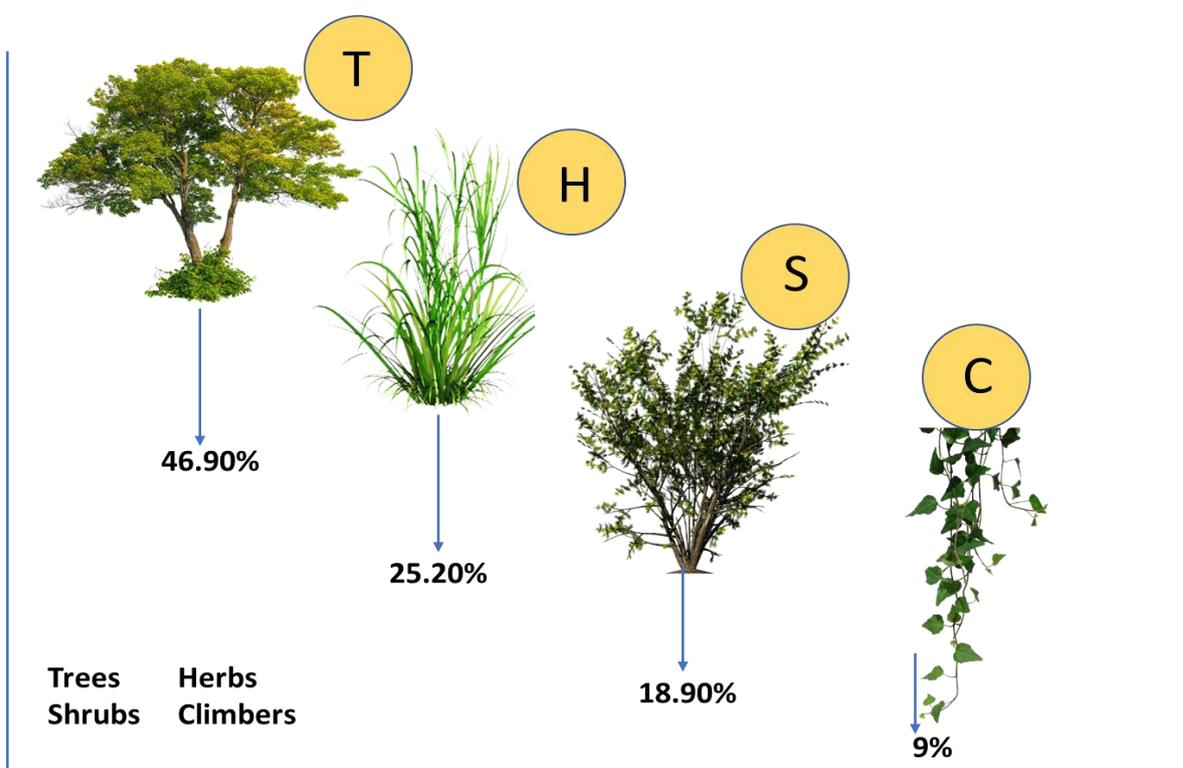
The campus has invasive species such as *Lantana camara* L., *Borassus flabellifer* L., and *Parthenium hysterophorus* L., This is clearly indicated disturbances to the natural setting in the vegetated areas.

The alien / exotic species viz., *Delonix regia.*, *Plumeria*, *Anthurium* and *Tecoma stans* (L.) Kunth are occur in the campus.

Some of the species are utilized as fruit yielding like *Mangifera indica* L. (Maa), *Psidium guajava* L., (Koyya), *Moringa olifera.* (Murungai), *Phyllanthus emblica* L. (Nelli), and Species such as *Bougainvillea glabra*, *Ixora coccinea* are exploited for their attractive flowers.



**Systematic groups of the plants in the
T. K. Madhava Memorial College campus**



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

The biodiversity of T. K. Madhava Memorial College Campus comprises a sum of 62 species belonging to 29 genera under 18 families besides the lichens, mycoflora, pteridophytes and bryophytes. Among the documented higher plants, Dicots are dominating with 13 families followed by monocots (5 families). Over all analysis revealed that trees were dominating flora (46.90%) followed by herbs, shrubs and climbers which accounts 25.20%, 18.90% and 9%, respectively. Among the documented dicots, Polypetalae formed a major proposition with 10 families, 12 genera and 18 species; Gamopetalae with 4 families, 7 genera and 9 species while

Monochlamydeae with 3 families, 4 genera and 6 species. In monocots 5 families are spreading over 9 genera belonging to 22 species. Poaceae is first dominant family and followed, Fabaceae, Bignoniaceae, and Rubiaceae with 8, 5, 3, 2 respectively. At the time of green campus audit at TKMM College, a total of 3 invasive floral species were recorded. This clearly specified the disturbances to the natural setting in the vegetated sector.

Table 5. List of Flowering plants in the TK Madhava Memorial College Campus

Sl. No	Common Name	Botanical Name	Family	Habit
1.	Candelabra Wattle	<i>Acacia lenticularis</i> Buch.	Mimosaceae	Tree
2.	Chick Weed / Billygoat	<i>Ageratum conyzoides</i> L.	Asteraceae	Herb
3.	Khaki Weed	<i>Alternanthera pungens</i> L	Amaranthaceae	Herb
4.	Round Leaf Alyce Clover	<i>Alysicarpus hamosus</i> Edgew.	Fabaceae	Herb
5.	Green Amaranth / Slender Amaranth	<i>Amaranthus viridis</i> L.	Amaranthaceae	Herb
6.	Bushy Bluestem	<i>Andropogon pumilus</i> Roxb.	Poaceae	Herb
7.	Thick Leaf Lavender	<i>Anisochilus carnosus</i> L.F	Lamiaceae	Herb
8.	Sixweeks Threeawn	<i>Aristida adscensionis</i> L.	Poaceae	Herb
9.	Broom Grass	<i>Aristida hystrix</i> L.f.	Poaceae	Herb
10.	Broom Grass	<i>Aristida setacea</i> Retz.	Poaceae	Herb
11.	Jack Fruit	<i>Artocarps heterophyllus</i> L.	Moraceae	Tree
12.	Neem Tree	<i>Azadirachta indica</i> A.	Meliaceae	Tree
13.	Palmyra Palm	<i>Borassus flabellifer</i> L.	Arecaceae	Tree
14.	Candelabra Wattle	<i>Bothriochloa compressa</i> H	Poaceae	Herb
15.	Creeping Bluegrass / Pinhole Grass	<i>Bothriochloa insculpta</i> Hochst.	Poaceae	Herb
16.	Hurricane Grass	<i>Bothriochloa pertusa</i> L.	Poaceae	Herb
17.	Great Bougainvillea	<i>Bougainvillea spectabilis</i> L	Nyctaginaceae	Shrub
18.	Armgrass Millet / Green	<i>Brachiaria distachya</i> L.	Poaceae	Herb
19.	Running Grass	<i>Brachiaria emiverticillata</i>	Poaceae	Herb
20.	Sweet Signal Grass	<i>Brachiaria eruciformis</i> (Sm.) Griseb.	Poaceae	Herb
21.	Browntop Millet	<i>Brachiaria ramosa</i> (L.) B.	Poaceae	Herb
22.	Candelabra Wattle	<i>Brachiaria semiundulata</i> L	Poaceae	Herb
23.	Cori Grass / Tropical Grass	<i>Brachiaria subquadripata</i> Trin.	Poaceae	Herb
24.	Peacock Flower	<i>Caesalpinia pulcherrima</i>	Caesalpinaceae	Shrub
25.	Giant Milkweed	<i>Calotropis gigantea</i> L.	Asclepidaceae	Shrub
26.	Honey-Thorn	<i>Canthium parviflorum</i> L.	Rubiaceae	Shrub
27.	Dark Purple Plant	<i>Caralluma bicolor</i> L.	Asclepidaceae	Herb
28.	Yellow Cassia	<i>Cassia spectabilis</i> DC.	Caesalpinaceae	Tree
29.	Kapok Tree	<i>Ceiba pentandra</i> (L.) G.	Bombacaceae	Tree
30.	White Buffel Grass	<i>Cenchrus pennisetiformis</i>	Poaceae	Herb

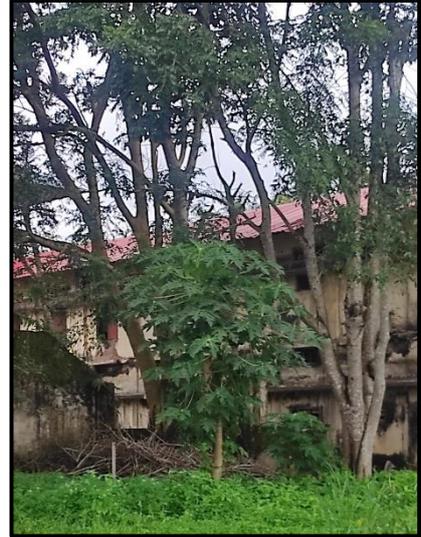
31.	Cow Sandbur / Birdwood Grass	<i>Cenchrus setigerus</i> Vahl.	Poaceae	Herb
32.	Bourne's Finger Grass	<i>Chloris bournei</i> Rang.	Poaceae	Herb
33.	Purpletop Rhodes	<i>Chloris inflata</i> Link	Poaceae	Herb
34.	Velvet Leaf	<i>Cissampelos pareira</i> L.	Menispermaceae	Climber
35.	Bitter Apple	<i>Citrullus colocynthis</i> L.	Cucurbitaceae	Climber
36.	Broom Creeper	<i>Cocculus hirsutus</i> L.	Menispermaceae	Climber
37.	Scarlet Cordia	<i>Cordia sebestena</i> L.	Boraginaceae	Tree
38.	Calabash Tree	<i>Crescentia cujete</i> L.	Bignoniaceae	Tree
39.	Smooth Rattlepod	<i>Crotalaria pallida</i> Dryand.	Fabaceae	Shrub
40.	Giant Dodder	<i>Cuscuta reflexa</i> Roxb.	Convolvulaceae	Climber
41.	The Queen Sago	<i>Cycas circinalis</i> L.	Cycadaceae	Tree
42.	Kachi Grass / Turpentine Grass	<i>Cymbopogon caesius</i> Nees	Poaceae	Herb
43.	Flame Tree	<i>Delonix regia</i> Boj.	Caesalpinaceae	Tree
44.	Flowered Desmodium	<i>Desmodium laxiflorum</i> DC.	Fabaceae	Shrub
45.	Painted Leaf Poinsettia / Mexican	<i>Euphorbia cyathophora</i> Murr.	Euphorbiaceae	Shrub
46.	Sacred Fig	<i>Ficus religiosa</i> L.	Moraceae	Tree
47.	White Teak	<i>Gmelina arborea</i> Roxb.	Verbenaceae	Shrub
48.	East Indian Screw Tree	<i>Helicteres isora</i> L.	Sterculiaceae	Shrub
49.	Globe Amaranth	<i>Indigofera longiracemosa</i>	Fabaceae	Shrub
50.	Jacaranda / Fern	<i>Jacaranda mimosifolia</i>	Bignoniaceae	Tree
51.	Bellyache Bush	<i>Jatropha gossypifolia</i> L.	Euphorbiaceae	Shrub
52.	Candelabra Wattle	<i>Macrotyloma ciliatum</i> Wil	Fabaceae	Shrub
53.	Indian Mulberry	<i>Morinda coreia</i> Buch.	Rubiaceae	Tree
54.	Drumstick Tree	<i>Moringa pterosperma</i> L.	Moringaceae	Tree
55.	Cork Bush	<i>Mundulea sericea</i> Willd.	Fabaceae	Tree
56.	West Indian Cherry	<i>Muntingia calabura</i> L.	Elaeocarpaceae	Tree
57.	Curry Leaf Tree	<i>Murraya koenigii</i> L.	Rutaceae	Tree
58.	Indian Sandalwood	<i>Santalum album</i> L.	Santalaceae	Tree
59.	Vegetable Huming bird	<i>Sesbania grandiflora</i> L.	Fabaceae	Tree
60.	Rosy Trumpet Tree	<i>Tabebuia rosea</i> (Berol.)	Bignoniaceae	Tree
61.	Yellow Stans	<i>Tecoma stans</i> (L.) Kunth.	Bignoniaceae	Tree
62.	Teak	<i>Tectona grandis</i> L. f.	Verbenaceae	Tree



Pongamia pinnata



Musa paradisiaca



Carica papaya



Bamboo bambusa



Plectranthus amboinicus



Aloe barbadensis



Phyllanthus niruri



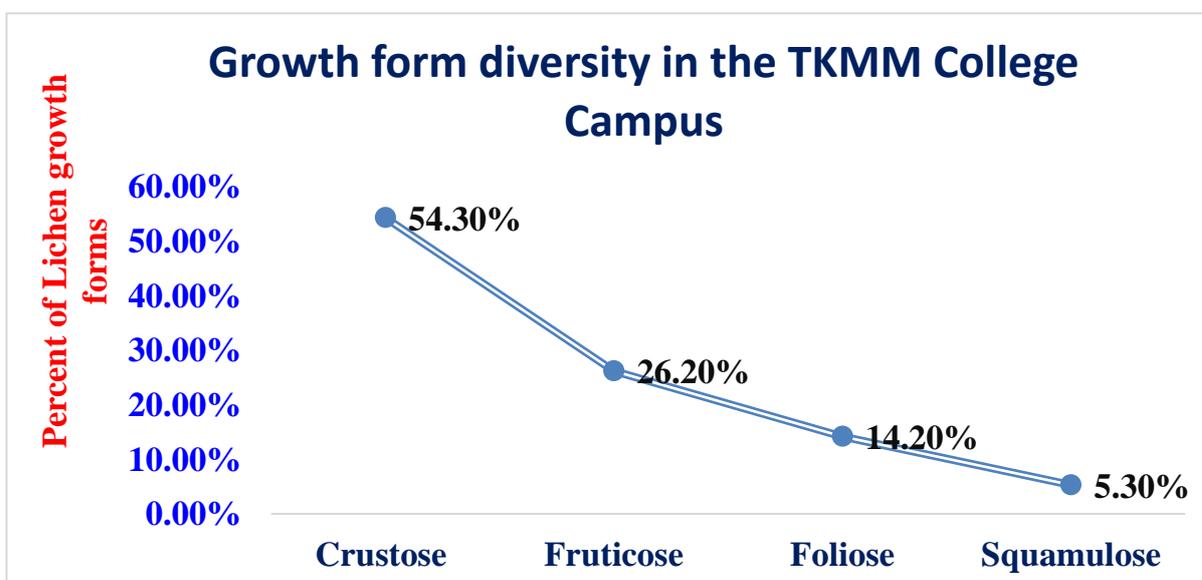
Cocos nucifera



Juniperus virginiana

13.3.1.2. Lichen diversity in the TKMM College campus

Lichens are one of the most fascinating symbiotic organisms found worldwide. The lichen 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 synergetic association between a fungal and an algal species results in lichens and occupied 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 recorded in the TK Madhava Memorial College campus showed a total of 8 different lichens species representing 4 genera and 4 families. Three species accounted for 10% of total available lichen diversity and identified up to species level while 46 were recognized to genus level. The observation on lichen diversity revealed that two types of lichens growth forms belonging to the genus, *Parmotrema* and *Lecanora* were accounted 5% diversity coming under crustose lichens and three types of foliose lichens belonging too the genus, *Dimeralla*, *Graphis* and *Pertusaria* were accounted. About 2% lichens were found to be one single species in each genus of fruticose lichens.

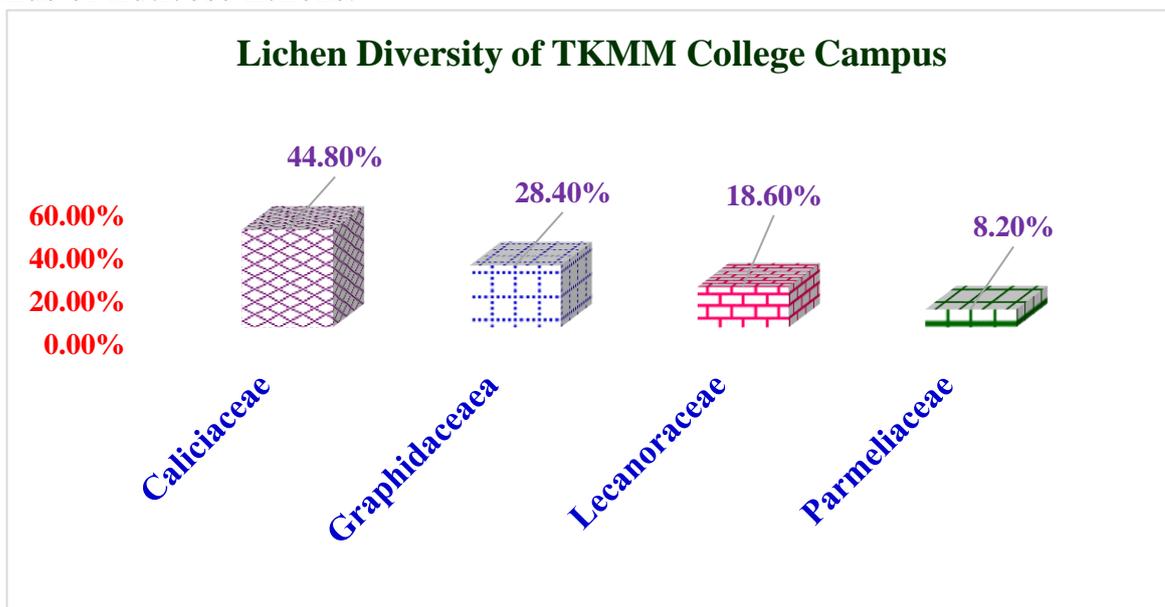


Table 6. Lichen diversity of the TK Madhava Memorial College with respect to family, substratum and growth forms in genus and family wise classification

S.No	Lichen diversity of the TK Madhava Memorial College campus	Family	Growth forms
1.	<i>Buellia pullata</i> Tuck	Caliciaceae	Crustose
2.	<i>Graphis glauconigra</i> Vainio	Graphidaceaea	Furticose
3.	<i>Lecanora perplexa</i>	Lecanoraceae	Foliose
4.	<i>Usnea coralline</i> Mot	Parmeliaceae	Furticose
5.	<i>Glyphis scyphulifera</i> (Ach.) Staiger	Graphidaceaea	Crustose
6.	<i>Graphis glauconigra</i> Vainio	Graphidaceaea	Furticose
7.	<i>Lecanora alba</i> Lumbsch, in	Lecanoraceae	Crustose
8.	<i>Usnea coralline</i> Mot	Parmeliaceae	Furticose

13.3.3. Algal diversity in the TKMM College campus

Oscillatoria, *Chara*, *Oedogonium*, *Spirogyra*, *Volvox*, *Chlamydomonas*, *Scytonema* and *Cladophora spp.* belonging to the class of Cyanophyceae, Chlorophyceae and Bacillariophyceae are the predominant species found in the campus. 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 TKMM College Campus ecosystem has high amount of organic nutrients in soil and rock. Generally, occurrence of abundant algal flora at a place indicates the availability of abundant nutrients along with conducive favourable environmental conditions.

13.3.1.3. Mushrooms diversity in the TKMM College campus

Mushrooms, edible basidiomycete, represent white rot fungi which contained higher amount of proteins, rich in minerals with medicinal properties. At present three mushroom varieties (white mushroom, the paddy-straw mushroom and the oyster mushroom) are being cultivated in India. These are most popular, economically sound to grow and is extensively cultivated throughout the world. Due to moderate temperature requirement for luxuriant growth, its cultivation are restricted to the cool malgrowth yield is influenced by the type of compost, spawn, temperature, percentage of moisture and also affected by the pests and disease-causing agents. There has been extensive discussed in recent years, as far as the production of fungal protein from domestic, agricultural and industrial wastes. Since mushrooms have a very short life span, 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.

The TKMM Collge campus has various mushroom types covering poisonous, edible and medicinal varieties such as white mushroom (*Agaricus bisporus*), the paddy-straw mushroom (*Volvariella volvacea*), oyster mushroom (*Pleurotus sajor-caju*), button mushroom (*Omphalotus olearius*) and other mushroom types such as *Amauroderma conjunctum*, *Ganoderma applanatum*, *Laccaria laccata* and *Volvariella bombycina*.

13.3.2. Fauna Diversity in the TKMM College campus

13.3.2.1. Birds Diversity in the TKMM College campus

The observations on fauna diversity indicated that the TKMM College campus has a large number of living as well as visiting animals, birds, reptiles and insects including termites. A total number of 14 birds belonging to the 2 species were recorded from different habitats during winter and summer, of them one of which were endemic to the deccan plateau like purple rumped sunbird. Totally 6 species of birds representing 2 families and 2 orders were observed during this study, passeiformes constituted the predominated group representing 9. Total number of 4 bird species, out of them 2 species were migrant, 2 species were local migrant during winter and summer season because of unfavourable environment and low availability of food resources. Migratory bird species like Mangrove heron, Common Wood shrike, Black-rumped flameback and Peacock.

Table 7. Birds Diversity in the TKMM College campus

S.no	Scientific name	Common name
1.	<i>Accipiter</i>	Shikra
2.	<i>Acridotheres tristis</i>	Common myna
3.	<i>Bubulcus ibis</i>	Cattle egret
4.	<i>Centropusparroti</i>	Barn owl-tylo alba
5.	<i>Dendrocitta vagabunda</i>	Rufous Tree pie
6.	<i>Dicruridaemacrocercus</i>	Black drongo
7.	<i>Haliasturindus</i>	Brahminy kite-
8.	<i>Leptocoma zeylonica</i>	Purple-rumped sunbird
9.	<i>Merops orientalis</i>	Green bee-eater
10.	<i>Orthotomus</i>	Tailorbirds
11.	<i>Plegadis falcinellus</i>	Glossy ibis-
12.	<i>Prinainornata</i>	Plain Priniap
13.	<i>Spilopelia chinensis</i>	Spotted dove
14.	<i>Vanellus malabaricus</i>	Yellow-wattled lapwing



Table 8. Total number of visiting birds in the TKMM College campus

S.No	Common Name	Scientific Name
1.	Common Babbler	<i>Argya caudate</i>
2.	Mangrove heron	<i>Butorides striata</i>
3.	Greater spotted eagle	<i>Clanga clanga</i>
4.	Koel	<i>Eudynamys scolopaceus</i>
5.	Small pratincole	<i>Glareola lacteal</i>
6.	Rose-ringed	<i>Psittacula krameri</i>
7.	Wood shrike	<i>Tephrodornis Pondicerianus</i>

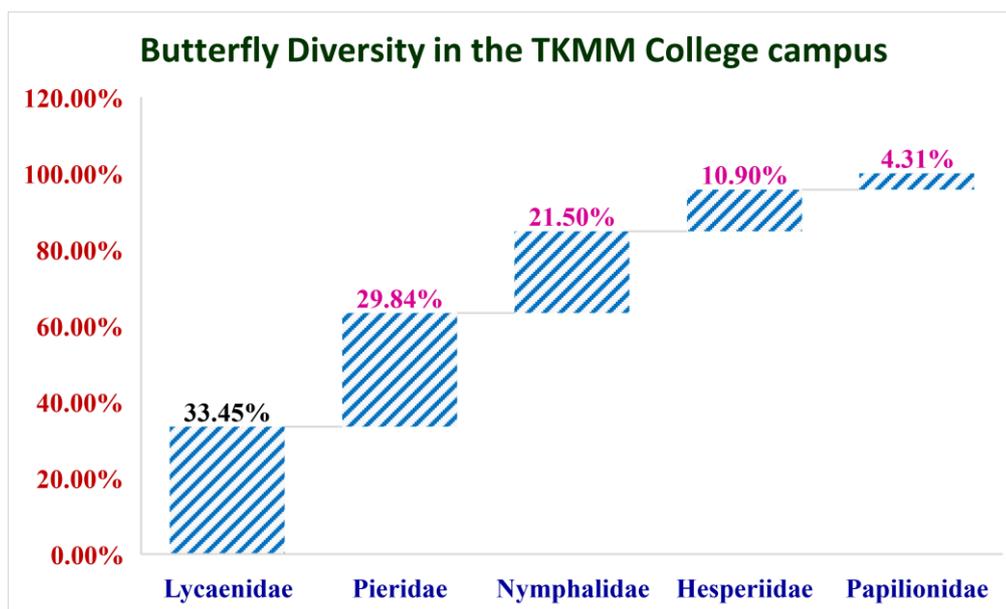
13.3.2.2. Butterflies diversity in the TKMM College campus

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

Table 9. List of Butterflies recorded in the TKMM College campus

S.No.	Common Name	Scientific Name	Family
1.	Common hedge	<i>Actolepis puspa</i>	Lycaenidae
2.	Common Hedge Blue	<i>Acytolepis puspa</i>	Lycaenidae
3.	Pioneer	<i>Belenois aurota</i>	Pieridae
4.	Angled pierrot	<i>Caleta caleta</i>	Lycaenidae
5.	Common mpierrot	<i>Castalius rosimon</i>	Lycaenidae
6.	Tamil yeoman	<i>Cirrochroa thais</i>	Nymphalidae
7.	Rustic	<i>Cupha erymanthis</i>	Nymphalidae
8.	Plain tiger	<i>Danaus chrysippus</i>	Lycaenidae
9.	African Marbled Skipper	<i>Gomalia elma</i>	Hesperidae
10.	Bamboo treebrown	<i>letheeopa</i>	Nymphalidae
11.	Common bushbrown	<i>Mycalesis perseus</i>	Nymphalidae
12.	Common sailor	<i>Neptis hylas</i>	Nymphalidae
13.	Lime Butterfly	<i>Papilio demoleus</i>	Papilionidae

Butterfly Diversity in the TKMM College campus



13.3.2.3. Mammals diversity in the TKMM College campus

Mammals, a group of vertebrate animals (class: Mammalia), characterized by the presence of mammary glands (where females produce milk for feeding/nursing their young), a neocortex (a region of brain), fur or hair and three middle ear bones. These characteristic features differentiate them from reptiles and birds. Observation on diversity of mammals in the TKMM College campus indicated that around 6 Mammal species are commonly distributed. The commonly found mammals are Black-naped Hare, Three-striped Palm Squirrel, Common or Grey Mongoose, Short-nosed Fruit Bat, House Rat and Indian Mole-rat.

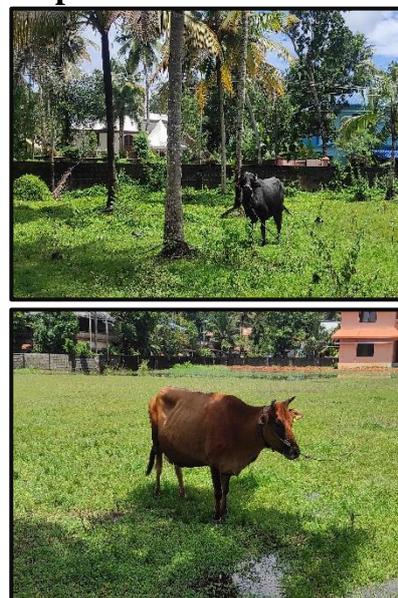


Table 10. List of Mammals diversity in the TKMM College campus

S.No.	Common Name	Scientific Name
1.	Black-naped Hare	<i>Lepus nigricollis</i>
2.	Three-striped Palm Squirrel	<i>Funambulus palmarum</i>
3.	Buffalow	<i>Bubalus bubalis</i>
4.	House Rat	<i>Rattus rattus</i>
5.	Indian Mole-rat	<i>Bandicota bengalensis</i>
6.	Cow	<i>Bos taurus</i>

13.3.2.4. Amphibians diversity in the TKMM College campus

Amphibians (class: Amphibia) are ectothermic, tetrapod vertebrates. All living amphibians represent the group Lissamphibia and they inhabit a wide variety of

habitats. Most of them living within terrestrial, fossorial, arboreal or freshwater aquatic ecosystems. Amphibians naturally start out as larvae living in water, but some species bypass this by developed behavioural adaptations. Observation made on diversity of Amphibians in the TKMM College indicated that around 4 species of Amphibians are commonly distributed.

Generally amphibians undergo metamorphosis from larva with gills to air-breathing adult with lungs. Skin of the Amphibians served as a secondary respiratory organ while very few terrestrial salamanders and frogs lack lungs and they rely entirely on their skin for respiration. With their complex reproductive needs and permeable skins, amphibians are often ecological indicators. In recent decades, there has been a drastic decline in populations of many amphibian species around the globe.

Historically, amphibians evolved in the Devonian period from sarcopterygian fish with lungs and bony-limbed fins, which were helpful them to adapt to dry land conditions. Their spread was higher and predominant during Carboniferous and Permian periods and they were later displaced by reptiles and other vertebrates. Over a period, amphibians shrank in size and their diversity decreased drastically, leaving only the modern subclass Lissamphibia. Modern amphibian orders include Anura (the frogs), Urodela (the salamanders) and Apoda (the caecilians). Number of known amphibian species is nearly 55% are frogs. Observation made in the TKMM College Campus on diversity of Amphibians revealed that around 3 species of Amphibians are commonly disseminated.

13.3.2.5. Grasshopper diversity in the TKMM College Campus

Grasshoppers, a group of insects belonging to the suborder Caelifera and they are probably 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 dynamically. As a hemimetabolous insects, they do not undergo complete cycle of metamorphosis. In other word, they hatch from an egg into a nymph or "hopper" which undergoes five moults, to become identical to that of an adult. Grasshoppers hear through the tympanal organ which can be found in the first segment of the abdomen attached to the thorax; its sense of vision is compound eyes. Under certain environmental conditions, some grasshopper species at high population densities can change colour and behaviour besides form swarms. Grasshoppers are plant-eaters; few species at times become as a serious pests of cereals, vegetables and pasture, especially when they swarm to destroy the crops over huge contiguous areas. Surveillance audit at TKMM College on diversity of Grasshoppers demonstrated that 3 species are Amphibians are commonly distributed which includes *Eyprepocnemis alacris*, *Cyrtacanthacris tartarica* and *Aulacobothrus luteipes*.

13.3.2.6. Termites Diversity in the TKMM College Campus

Termites are 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. Eusocial insects, commonly Termites, are taxonomically ranking as infraorder. Isoptera, or alternatively as epifamily Termitoidae, within the order Blattodea (along with cockroaches). Although Termites are habitually

known as "white ants", they are not ants and they are not closely related with them. Earlier, Termites were classified as a separate order from cockroaches. Recent phylogenetic studies revealed that they evolved from cockroaches, as they are deeply nested within the group and the sister group found to wood eating cockroaches of the genus *Cryptocercus*. More recent estimates suggest that they have originated during the Late Jurassic period evidenced with the first fossil records in the Early Cretaceous. Termites mostly nourish on cellulose based dead plant material (wood, leaf litter), soil and animal dung. Two species of Termites (*Odontotermes anamallensis*, *Trivitermes fletcheri*) recorded during on-site Green Campus audit at TKMM College and they are belonging to the Genera *Odontotermes*, *Trivitermes* and *Nasutitermes*.

13.4. An account of more Oxygen releasing and Carbon dioxide assimilating plants in the TKMM College Campus

There are some plants which are being considered highly efficient in oxygen releasing and carbon dioxide assimilating (Carbon sinks) 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. *Sansevieria zeylanica* (commonly known as snake plant or the mother-in-law's tongue plant) is unique for oxygen release during night time and it is able to purify the atmospheric air in terms of removal of toxic gases. Although options are available to enhance the level of oxygen by reducing CO₂ with the aid of oxygenators and air purifiers, there are certain alternatives to improve the air quality which is beneficial for both body and mind. Green campus audit at TKMM College campus revealed that the campus is well distributed with more oxygen releasing and CO₂ assimilating plants such as *Money plant*, *Neem tree*, *Tamarind tree*, *arali*, and *Pongam* trees. There are 6 plant species which are able create an eco-friendly atmosphere in terms of reducing erosion, moderating the climate, improving air quality and supporting wildlife besides they are economically important and valued for different medicinal aspects.

The ornamental plants such as Java Plum / Jamun (*Syzygium cumini*), Yellow Trumpetbush / Yellow Bells (*Tecoma stans*) are made available. In addition, medicinal plant such as *Tinospora cordifolia* and *Medicinal garden* is also available in the campus.

Oxygen releasing and Carbon dioxide assimilating plants in the TKMM College Campus

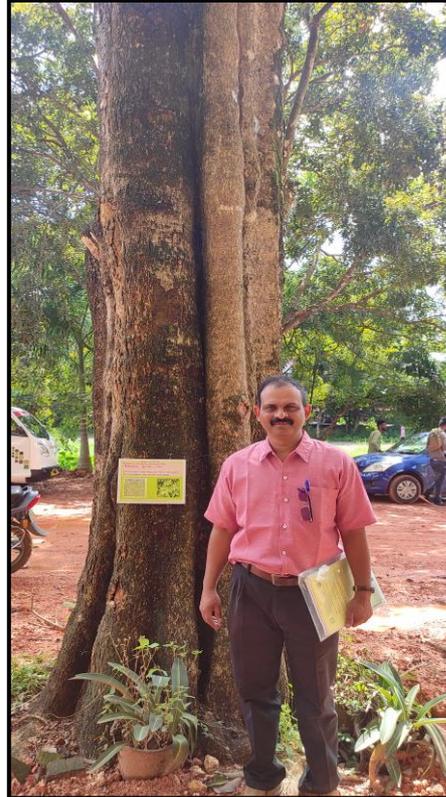
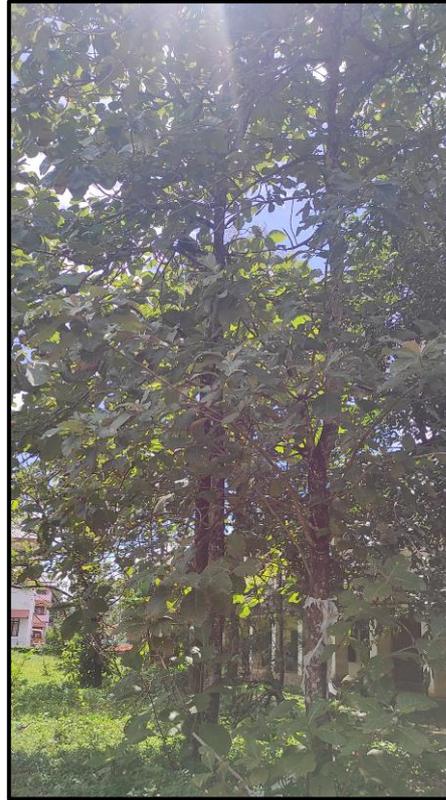


Table 11. List of Oxygen releasing and Carbon dioxide assimilating, Ornamental / Medicinal plants in the TKMM College Campus

S.No	Plant Name (Malayalam Name)	Plant Name (English)	Scientific Name	Grouping / Nature	Characteristic Features of the plant
1.	Kuppaimeni	Copper leaf	<i>Acalypha wilkesiabna</i>	Dicots	O ₂ releasing Plant
2.	Katralai	Aloe Vera	<i>Aloe barbadensis miller</i>	Dicots	O ₂ releasing Plant
3.	Aryavep	Neem	<i>Azadirachta indica</i>	Dicots	O ₂ releasing Plant
4.	Muḷa	Bamboo	<i>Bambusa vulgaris</i>	Monocots	O ₂ releasing Plant
5.	Kavuññ	Areca Palm	<i>Dypsis lutescens</i>	Monocots	O ₂ releasing Plant
6.	Vilapikkunna	Weeping Fig	<i>Ficus benjamina</i>	Dicots	O ₂ releasing Plant
7.	Arasu	Peepal, Bot-tree	<i>Ficus religiosa</i>	Dicots	O ₂ releasing Plant
8.	Cainakkāran	Chinese ixora	<i>Ixora chinensis</i>	Monocots	O ₂ releasing Plant
9.	Sinduram	Sxarlet jungle flame	<i>Ixora coccinea</i>	Monocots	O ₂ releasing Plant
10.	Thulasi	Tulsi	<i>Ocimum tenuiflorum</i>	Dicots	O ₂ releasing Plant
11.	Vaḷanpuḷi	Tamarind	<i>Tamarindus indica</i>	Dicots	O ₂ releasing Plant
12.	Paṇam	Money Plant	<i>Epipremnum aureum</i>	Monocots	O ₂ releasing Plant

Oxygen releasing and Carbon dioxide assimilating, Ornamental / Medicinal plants in the TKMM College Campus



13.5. Lawns, Trees, Herbs, Shrubs, Climbers and Lianas in the TKMM College 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 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.

The TKMM College campus has a huge number of trees, herbal plants, bushes, 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. The commonly available native as well as wild shrub species in the TKMM College campus are Kakithapoo (*Bougainvillea spectabilis*), Madhanakamaboo (*Cycas revolute*), Sembaruthi (*Hibiscus rosa-sinensis*), Vetchi (*Ixora coccinea*), Malli (*Jasminum sambac*) and Arali (*Nerium odorum*).

Similar to that of shrubs, there are 3 kinds of herbs available in the TKMM College campus. The predominant species of herbs available in the TKMM College campus are, (Croton) *Tradescantia spathaceae* and (Bright eyes) *Vinca rosea*.

The existence of climber, creepers, twiners and lianas species available which accounted more than seven species in the TKMM College campus is Amirtaval (*Tinospora cordifolia*). The major grasses are Arugam Pillu (*Cynodon dactylon*), Korai Pollu (*Cyperus rotundus*) and Crowfoot grass (*Dactyloctenium aegyptium*). Weak stemmed creeper plants grow alongside the ground, depends another plant support, or climb up a wall by means of extending stems or branches. Climbers, include herbs or shrubs, whose stems are weak, which needs support to grow, where it climb up trees and walls and grow vigorously without any pest and disease attach which are observed in the TKMM College campus.

13.6. Establishment of different Gardens in the TKMM College 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 *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.

In TKMM College, they are planted ornamental plants for the display of appealing characteristic features including: varying types of leaves and their texture, flowers and their fragrance, fruit, stem and bark. In some places, plants unusual features also planted to be of interest, such as the prominent thorns of cactus and snake cactus. There are 10 varieties of ornamentals plants we are maintaining surrounding of our college campus. In front of principal's room, cafeteria, college grounds and many places planted ornamentals plants. Nearly 25 plants in different places. These plants are making the college campus pleasantly and decoratively. Every year they try to plant new varieties with help of Environmental department. Once in three months the unwanted barks of the plants are cut it down, to make the beautification of their campus. No plant is cut unless it becomes dead. Not only can visitors enjoy seeing the ornamentals plants and also humming birds, butterflies shelter in that. This environment makes campus greenish and pleasant.

13.7. Natural Topography and Vegetation

Natural topography means the original geographical features of the campus, around 70-75% 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 71% 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 the TKMM College campus indicated that more than 55% natural topography and vegetation have been maintained properly. Further, there was no anthropogenic activity in some of the interior 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, bonds, 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 constructed near the building for rainwater harvesting and connected with pipes from the roof of the building to pit. During the audit, there having well developed rain harvesting systems such as pond like setup which surrounds the trees were observed with the TKMM College campus. Rainwater harvesting structures have been commissioned in the campus at different locations.

13.9. Landscape design and Soil Erosion control

Landscape management is the maintenance of land to make sure that backgrounds can fulfil the needs and objectives in an effective and sustainable manner for current and future members. It is an action that forms a perception of viable expansion, to ensure the preservation of a panorama, in order to help and harmonize alterations which are supplemented 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 the TKMM College campus has very good landscape design without disturbing the natural vegetation. 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.

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. The TKMM College campus 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. The TKMM College 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 the TKMM College 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 obstacles. The pedestrian path is otherwise called as zebra crossing by the combination of black and white stripes remained 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. The TKMM College 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 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 the TKMM College to cultivate plants. Agrochemicals, chemical fertilizers (urea, murate of potash, sulphate of potash, 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.

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/Student Force 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, 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 TKMM College has well developed NCC/Student Force, 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 Nangiarkulangara of Alappuzha. The TKMM College 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. The TKMM College 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.

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. The TKMM College 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. The TKMM College faculty members and students from various subject domains are doing extensive project work related to nature conservation, environmental pollution, soil and water analysis.

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

1. It is observed that the TKMM College is maintaining more than 71% 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 23% and planted vegetation was 68%.
2. The TKMM College campus is established in South Western Ghats of India, belonging to Alappuzha 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. The TKMM College has created 'Ornamental 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. It was initiated by following the method of 'Miyawaki Concept' 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 the TKMM College campus, a sum 62 species belonging to 29 Genera under 18 families covering trees, herbs, shrubs, climbers, lianas, twiners and lawns and 8 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 the TKMM College campus, a total of 6 living Mammals representing two Genera under two families, visiting Mammal species 4, 14 species of birds, 3 species of Grasshopper, 2 species of Termites, 4 species of Amphibians, 4 species of Reptiles, 13 species of Butterflies and Three species Mosquitos were recorded and documented.
6. The TKMM College has established rainwater harvesting models, percolation pond 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 releasing and carbon dioxide assimilating plants such as *Areca* Palm, Banyan tree, Money plant, Neem tree, *Arjun* tree and *Pongam* trees including some of the shrub and herbal plants.
8. 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.
9. Gardens inside the college premises are found well maintained.
10. Hundred percent ban of plastics in the campus (Thermocole/Plastic plates, Cups, Water bottles, etc.,)
11. Waste Management in the Canpus is one of the Best Practices.

15. Recommendations for Greening

- Honey Bee hives may be kept in the campus which is free from student's mobilization. Honeybees are natural pollinators help 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 (EC), water holding capacity (WHC), 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.
- 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.

- TKMM College 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 virtualization technology.
- Eco club student chapters, forums, cells, etc. may be established to among the students from which a large number of programmes on nature conservation and environmental protection may be conducted to rural, tribal and urban people.
- Proper treatments for waste were also suggested.
- Use of fossil fuels has to be reduced for the sake of community health.
- Rain water harvesting systems, solar power generation, environmental education programs have to be strengthened.
- Exotic grassland can be replaced by growing native grasses which yield revenue

16. Conclusion

After the establishment of TKMM College, Alappuzha, Kerala, it has made significant progressive contributions with respect to teaching learning, research and consultancy, innovation and transfer of technology, community service and value education, *in toto*. The TKMM College is a well-established Government Aided Institution in Alappuzha which imparts quality education to rural, tribal and urban people across the Nation. This Organization is excellent in terms of academic activities and providing an eco-friendly atmosphere to the stakeholders. The Organization 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. The TKMM College Campus is maintaining more than 71% of the green cover area after building construction along with 23% of natural vegetation and 68% planted vegetation.

The natural topography and very good landscape design without disturbing the natural vegetation are being maintained by the TKMM College. A maximum number of more oxygen releasing and carbon dioxide assimilating plants are being maintained to provide pure atmosphere to the stakeholders. The installation of a rainwater harvesting system, percolation ponds and drip irrigation system to conserve rainwater and ground water are noteworthy in the campus. The Organization has created medicinal, herbal and ornamental gardens at small scale level for establishing a massive reforestation / afforestation planting programme in which a large number of trees and shrubs species were planted together for providing an eco-friendly atmosphere to the stakeholders in a sustainable manner.

17. Acknowledgement

Nature Science Foundation, Coimbatore, Tamil Nadu, India is grateful to the Principal and IQAC coordinator of the TKMM College, Alappuzha, Kerala, for providing necessary facilities and co-operation extends during the Green Campus Audit. This helped us in making the audit a magnificent success. Further, we hope Concept of establishing and maintenance of Green Campus proposed by the TKMM College Management will create Clean and Green Environment and this will be taken care of by up coming generation and propagate further.

Methodology for Flora and Fauna Identification

I. Identification of Flowering Plant Species

Various vascular plant species were identified based on the following identification key by adopting the polyphasic taxonomic approach

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 connate	41
4a. Corolla and calyx present.....	5
b. Corolla and calyx absent.....	24
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	Magnoliaceae
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 apocarpous.....	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	Viloiaceae
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
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	Caesalpiniaceae
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 parasitic47
- 47a. Leaves opposite; stamens 2.....--48
 b. Leaves alternate; stamens 4 or more49
- 48a. Leaves not scabrid, corolla tube white: fruits berryOleaceae
 b. Leaves scabrid; corolla tube orange; fruits capsulesNyctanthaceae
- 49.a. Anther inseperatable; corona presentAsclepidiaceae
 b. Anther seperatable; corona absentApocyanaceae
- 50a. Corolla lobes imbricate ;fruit drupeBoraginaceae
 b. Corolla lobes plicate; fruit capsuleConvolvulaceae
- 51.a Ovary cells many ovulatedSolanaceae
 b. Ovary cells 1-4 ovuled.....52
- 52.a Carpels 2 or more ovulated ; fruits dehiscent53
 b. Carpels 1 –ovulated ; fruits indehiscent57
- 53.a Fruits dehiscent; seeds supported on reticulæ.....Acanthaceae
 b. Fruits indehiscent; seeds not supported on reticulæ.....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 tubularAmarathaceae
 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 eglandular.....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. Arbrorescent 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.....	74

II. Identification of Non-Flowering Plant Species

Lichen samples were identified based morphological, biochemical and anatomical features and representative samples were compared with the voucher specimens at the Lichen Herbarium Centre of National Botanical Research Institute (NBRI), Lucknow, Uttar Pradesh, India.

Key to identify the Lichen Genera

Key to Genera

1 a. Photobiont cyanobacteri urn	<i>Leptogium cyanascens</i> .
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,.....	<i>Chrysothrix chlorina</i>
1 b. Thallus crustose.....	<i>Graphis</i> sp

Group II

1 a. Lower side of thallus pseudocyphellae, photobiont Nostoc	<i>Pseudocyphellaria</i>
1 b. Thallus lacking pseudocyphellae	2
2 a. Upper cortex thick walled longitudinally oriented, conglutinate hyphae.....	3
2 b. Upper cortex otheriwse.....	4
3 a. Thallus lower side canaliculated zeorin, norstictic and salazinic acids, and unknown pigments and triterpenoids present.....	<i>Heterodermia leucomelos</i>
3 b. Thallus lower side no canaliculated only in medulla.....	<i>Heterodermia diademata</i>
4 a. Cilia bulbate at the base, thallus grey to grey brown	<i>Bulbothrix</i>
4 b. Cilia present or absent, not bulbate.....	5
5 a. Rhizines dichotomously branched present throughout the margins....	<i>Hypotrachyna</i>
5 b. Rhizines restricted to center of lower surface, margin bare, smooth shining.....	6
6 a. Lobes narrow, long, dichotomously branched, canaliculate.....	<i>Everniastrum</i>
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 absent	11
9 a. Thallus with isidia.....	<i>Parmotrema tinctorum</i>
9b Thallus with soredia.....	12
10 a. thallus emaculate.....	<i>P.stuppeum</i>
10 b. thallus maculate.....	<i>P.reticulatum</i>
11 a. Protolichesternic acid in medulla	<i>P.grayanam</i>
11 b. Alecoronic acid in medulla.....	<i>P. nilgherrense</i>
12 a. Thallus large lobed, loosely attached, mainly corticolous	<i>P. austrosinense</i>
12 b. Thallus smaller, closely to strongly attached, saxicolous.....	<i>P.defectum</i>

Group III

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

III. Identificayion of Algae Genera

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.

Key to identify the Algae species

1A. Plant pigments contained in chromatophores or chloroplasts -----	10
1B. 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; -----	<i>Agmenellum</i>
3B. Cells somewhat evenly arranged toward periphery of spherical colony; barely visible gelatinous strands radiate from center of colony to cells ----	<i>Gomphosphaeria</i>
3C. Colony asymmetrical; cells very dense and unevenly distributed -----	<i>Anacystis</i>
4A. Filaments straight or slightly flexed -----	6
4B. Filaments curved, twisted, or spiralled -----	5
5A. Heterocysts and akinetes present -----	<i>Anabaena</i>
5B. Heterocysts absent -----	<i>Raphidiopsis</i>
6A. Heterocysts present -----	9
6B. Heterocysts absent -----	7
7A. Filaments without a sheath; cells discoid -----	<i>Oscillatoria</i>
7B. Filaments with distinct sheath -----	8
8A. Trichomes tangled; sheaths confluent -----	<i>Phormidiwn</i>
8B. Trichomes separate; sheaths not confluent -----	<i>Lyngbya</i>
9A. Heterocysts terminal -----	<i>Cylindrospermum</i>

9B. Heterocysts intercalary -----	<i>Aphanizomenon</i>
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 -----	<i>Stephanodiscus</i>
13B. Valves with two concentric regions, the inner being smooth -----	<i>Cydotella</i>
14A. Frustules with marginal keel containing a raphe -----	<i>Surirella</i>
14B. Frustules with a pseudoraphe or with a raphe not in a marginal keel ---	<i>Cocconeis</i>
15A. Frustules cylindrical arranged end to end into filament -----	<i>Melosira</i>
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 -----	<i>Tabellaria</i>
17B. Frustules not in zigzag chains -----	<i>Pseudoraphe</i>
18A. Frustules united laterally -----	<i>Fragilaria</i>
18B. Frustules not united laterally -----	19
19A. Frustules united apically forming spokelike colony -----	<i>Asterionella</i>
19B. Frustules not forming spokelike colony -----	20
20A. Frustules needle shaped without costae -----	<i>Synedra</i>
20B. Frustules with prominent costae -----	<i>Diatom</i>
21A. Frustules sigmoid or "S" shaped -----	<i>Gyrosigma</i>
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
23A. Valves with transverse costae -----	<i>Epithemia</i>
23B. Valves without transverse costae -----	24
24A. Raphe a smooth curve with well defined central and polar nodules ----	<i>Cymbella</i>
24B. Raphe not a smooth curve, gibbose with marginal central nodule -----	<i>Amphora</i>
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 -----	<i>Rhoicosphenia</i>
26B. Frustules shaped otherwise -----	<i>Achnanthes</i>
27A. Raphe extended length of valve; polar nodules; central nodules lacking -	<i>Eunotia</i>
27B. Raphe restricted to polar regions -----	28
28A. Raphe located in a canal -----	<i>Nitzschia</i>
28B. Raphe not located in a canal -----	29
29A. Frustules with symmetrical valves -----	30
29B. Frustules with valves symmetrical but asymmetrical -----	<i>Gomphonema</i>
30A. Valves with transverse costae -----	<i>Pinnularia</i>
30B. Valves with transverse punctae -----	<i>Navicula</i>
31A. Cells solitary -----	45
31B. Cells colonial or grouped -----	32
32A. Cells enclosed in conical to cylindrical lorica; joined lorica have treelike	

appearance -----	<i>Dinobryon</i>
32B. Cells and lorica without treelike appearance -----	33
33A. Colony discoid, one cell in thickness; cells in concentric rings -----	<i>Pediastrum</i>
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 -----	<i>Actinastrum</i>
35B. Colony with cells not radiating from common center -----	36
36A. Colony with four to eight cells positioned in linear series -----	<i>Scenedesmus</i>
36B. Colony with cells not in linear series -----	37
37A. Colony with arcuate to lunate cells with apices acutely -----	<i>Selenastrum</i>
37B. Colony with spherical to broadly ellipsoidal cells -----	38
38A. Cells without spines or setae -----	<i>Crucigenia</i>
38B. Cells with spines or setae -----	39
39A. Cells quadrate, closely apposed; free face of each cell with spines ----	<i>Tetrastrum</i>
39B. Cells quadrate and united; free face cell with long delicate setae ---	<i>Micractinium</i>
40A. Colony with biflagellated cells -----	<i>Pandorina</i>
40B. Colony with nonflagellated cells -----	41
41A. Cells lunate to sickle shaped -----	<i>Kirchneriella</i>
41B. Cells spherical or nearly so -----	42
42A. Cells borne terminally on dichotomously branched threads -----	<i>Dictyosphaerium</i>
42B. Cells not on dichotomously branched threads -----	43
43A. Colony a hollow sphere -----	<i>Coelastrum</i>
43B. Colony not a hollow sphere -----	44
44A. Colony surrounded by gelatinized and expanded parent cell wall -----	<i>Oocystis</i>
44B. Colony with cells equidistant and toward periphery -----	<i>Sphaerocystis</i>
45A. Cells with median constriction dividing cell into two distinct halves -	<i>Cosmarium</i>
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 -----	<i>Peridinium</i>
48B. Cells walls with faintly distinct plates and sutures -----	<i>Glenodinium</i>
49A. Cells uniflagellate -----	52
49B. Cells biflagellate -----	50
50A. Cells with two flagella of equal length -----	<i>Chlamydomonas</i>
50B. Cells with two flagella of unequal length -----	51
51A. Cells with single chromatophore -----	<i>Chroomonas</i>
51B. Cells with 2 large chromatophores -----	<i>Cryptomonas</i>
52A. Cells surrounded by distinct lorica -----	<i>Trachelomonas</i>
52B. Cells without lorica; fusiform to acicular shaped; posterior end -----	<i>Euglena</i>
53A. Cells acicular to fusiform with ends tapering into long spines -----	<i>Schroederia</i>
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 -----	<i>Chodatella</i>

- 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*

IV. Identification of Major Groups of Mushrooms

Mushrooms are belonging to fungal kingdom which are edible and non-edible in nature. They represented in various colours starting from white, black, brown, red and pale yellow rot fungi. They are identified based on the following characterization key

Key to identify the Mushrooms species

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. Raphe a smooth curve with well defined central and polar nodules -----*Cymbella*
7. Raphe not a smooth curve, gibbose with marginal central nodule -----*Amphora*
8. Frustules with raphe in both valves -----27
9. Frustules with pseudoraphe in one valve and raphe in other valve -----26
10. Colony with cells not radiating from common center -----36
11. Colony with four to eight cells positioned in linear series -----*Scenedesmus*
12. Colony with cells not in linear series -----37
13. Colony with arcuate to lunate cells with apices acutely-----*Selenastrum*
14. Cells acicular to fusiform with ends tapering into long spines -----*Schroederia*
15. Cells without ends tapering into long spines -----54
16. Cells without setae -----56
17. Cells with setae -----55
- 18 Cells with subpolar or both subpolar and equatorial long setae -----*Chodatella*
19. Raphe extended length of valve; polar nodules; central nodules lacking ----*Eunotia*
20. Raphe restricted to polar regions -----28
21. Raphe located in a canal -----*Nitzschia*
22. Filaments with distinct sheath -----8
23. Trichomes tangled; sheaths confluent -----*Phormidiwn*
24. Trichomes separate; sheaths not confluent -----*Lyngbya*
25. Heterocysts terminal -----*Cylindrospermum*
26. Heterocysts intercalary -----*Ahphanizomenon*
27. Cell walls without punctae or striae -----31
28. Cell walls rigid, ornamented with punctae or striae ----- 11
29. Frustules adiametric, two or more times longer than wide, elongate -----15
30. Frustules isodiametric, generally shorter than round or elliptical or ovoid ----- 12
31. Frustules elliptical or ovoid or nearly so -----14
32. Frustules discoid or nearly so -----13

33. Valves radially punctate -----*Stephanodiscus*
 34. Valves with two concentric regions, the inner being smooth -----*Cydotella*
 35. Frustules with marginal keel containing a raphe -----*Surirella*
 36. Frustules with a pseudoraphe or with a raphe not in a marginal keel -----*Cocconeis*
 37. Cap round in outline; pore surface not running down the stem, or only slightly running down the stem; spore print not white -----*Boletes*
 38. 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*
 39. 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*
 40. 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*
 41. Cap shape convex to centrally depressed or vase-shaped; undersurface, smooth, wrinkled, or gill-like; fruiting embedded -----*Chanterelles*
 42. 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*
 43. 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*
 44. Found in summer and fall (or spring in warm coastal areas); cap lobed, saddle-shaped, or irregular and whitish, greyish, brownish, or black; stem surface ribbed or "pocketed" in some species -----*Saddles*
 45. Found in summer and fall (or spring in warm coastal areas); cap lobed, saddle-shaped, or irregular and whitish, greyish, brownish, or black -----*Oddballs & Misfits*

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Mobile	9566777255	Email:	chairmannsf@gmail.com																											
DATE OF INCORPORATION / REGISTRATION OF ENTERPRISE		28/11/2017																												
DATE OF COMMENCEMENT OF PRODUCTION/BUSINESS		12/03/2020																												
NATIONAL INDUSTRY CLASSIFICATION CODE(S)		<table border="1"> <thead> <tr> <th>SNo.</th> <th>NIC 2 Digit</th> <th>NIC 4 Digit</th> <th>NIC 5 Digit</th> <th>Activity</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>69 - Legal and accounting activities</td> <td>6920 - Accounting, bookkeeping and auditing activities; tax consultancy</td> <td>69201 - Accounting, bookkeeping and auditing activities</td> <td>Services</td> </tr> <tr> <td>2</td> <td>85 - Education</td> <td>8542 - Cultural education</td> <td>85420 - Cultural education</td> <td>Services</td> </tr> <tr> <td>3</td> <td>85 - Education</td> <td>8549 - Other education n.e.c.</td> <td>85499 - Other educational services n.e.c.</td> <td>Services</td> </tr> </tbody> </table>				SNo.	NIC 2 Digit	NIC 4 Digit	NIC 5 Digit	Activity	1	69 - Legal and accounting activities	6920 - Accounting, bookkeeping and auditing activities; tax consultancy	69201 - Accounting, bookkeeping and auditing activities	Services	2	85 - Education	8542 - Cultural education	85420 - Cultural education	Services	3	85 - Education	8549 - Other education n.e.c.	85499 - Other educational services n.e.c.	Services					
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DATE OF UDYAM REGISTRATION		26/02/2022																												

* In case of graduation (upward/reverse) of status of an enterprise, the benefit of the Government Schemes will be availed as per the provisions of Notification No. S.O. 2119(E) dated 26.06.2020 issued by the M/o MSME.

Disclaimer: This is computer generated statement, no signature required. Printed from <https://udyamregistration.gov.in> & Date of printing - 26/02/2022

For any assistance, you may contact:

1. District Industries Centre: COIMBATORE (TAMIL NADU)
2. MSME-DI: CHENNAI (TAMIL NADU)

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Please Update Your Profile

Welcome, Nature Science Foundation

Your Unique Id: TN/2018/0187711



PROCEEDINGS OF THE COMMISSIONER OF INCOMETAX (EXEMPTIONS),
III FLOOR, ANNEXE BLDG, NO.121, MAHATMA GANDHI SALAI, CHENNAI-34

Present : G.M.DOSS, I.R.S
Commissioner of Income Tax (Exemptions)

** URNo. AACTN7857J/05/18-19/T-1105

Dated:03/09/2018

Sub: Registration u/s. 12AA of the Income tax Act 1961 - in the case of

"Nature Science Foundation"

LIG-II, 2669, Gandhima Nagar, Peelamedu, Coimbatore – 641 004.

Ref : Application in form 10 A filed on 28/03/2018

ORDER UNDER SECTION 12AA OF THE INCOME TAX ACT 1961.

1. The above Trust/Society/Association/ Company/ others/, bearing PAN AACTN7857J was constituted by Trust Deed / Memorandum of Association dated 29/11/2017 registered with Sub-Registrar's Office/ Registrar of Societies/Registrar of Companies/others on 29/11/2017.
2. ~~The Trust Deed / Memorandum of Association has subsequently been amended / modified / altered by a Codicil / Supplementary Deed / Amendment Deed / Alteration to Memorandum of Association/others dated XX/XX duly registered on XX/XX.~~
3. The above TRUST filed an application seeking Registration u/s 12 AA of the Income tax Act, 1961.
4. On going through the objects of the TRUST and its proposed activities as enumerated in the Trust Deed / Memorandum of Association, I am satisfied about the genuineness of the TRUST as on date.
5. The application has been entered at Sl.No.1105 maintained in this office. The above Trust is accordingly registered as a PUBLIC CHARITABLE TRUST u/s 12 AA of the Income Tax Act, 1961 with effect from 29/11/2017.
6. It is hereby clarified that the Registration so given to the Trust/Institution is not absolute. Subsequently, if it is found that the activities of the Trust/Institution are not genuine or are not being carried out in accordance with the objects and clauses of the Trust Deed / Memorandum of Association submitted at the time of registration or modified with the approval of the Commissioner of Income-tax (Exemptions), Chennai or there is a violation of the provisions of Section – 13, the Registration so granted shall be cancelled as provided u/s 12 AA (3) or 12AA(4) of the Income Tax Act. Further, this approval is also subject to the Trust/Society/Association/Company/ Others/ complying to the provisions of the proviso to sec 2(15) of the Income Tax Act 1961.
7. Granting of Registration u/s 12AA does not confer any automatic exemption of income from taxation. The Trust/Institution should conform to the parameters laid down in Sections 11, 12, 13 and 115 BBC of the I.T. Act, 1961, to claim exemption of its income on year to year basis before the Assessing Officer.

** This Unique Registration No. URNo. AACTN7857J/05/18-19/T-1105 Should be mentioned in all your future correspondence.



Sd/-
(G.M.DOSS, I.R.S)
Commissioner of Income-tax(Exemptions), Chennai.

Copy to:

1. The Assessee.
2. The ACIT(Exemptions), Coimbatore Circle.
3. Office Copy.

//CERTIFIED TRUE COPY//

(N SRINIVASA RAO)
Asst. Commissioner of Income-tax (H.Qrs)(Exemptions),
Chennai.

GOVERNMENT OF INDIA
INCOMETAX DEPARTMENT

OFFICE OF THE COMMISSIONER OF INCOME TAX (EXEMPTIONS)
Aayakar Bhawan, Annexe III Floor, 121 M.G. Road, Chennai 600 034

URNo. AACTN7857J/05/18-19/T-1105/80G

Date: 10.04.2019

Name of the Trust-/Society
/Company/Institution : NATURE SCIENCE FOUNDATION
Address : LIG II 2669, GANDHIMAA NAGAR, PEELAMEDU,
COIMBATORE - 641 004
PAN : AACTN7857J
Date of Application : 12.11.2018

Received
Rajiv S. Ponnudurai
17/07/2019

APPROVAL UNDER SECTION 80G(5)(vi) OF THE INCOME TAX ACT, 1961

The aforesaid Trust-/Society/Company/Institution has been registered u/s.12AA of the Income Tax Act with effect from 29.11.2017 vide AACTN7857J/05/18-19/T-1105 dated 03.09.2018. It is certified that donation made to NATURE SCIENCE FOUNDATION at LIG II 2669, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004 shall qualify for deduction u/s 80G(5)(vi) of the Income Tax Act, 1961, subject to the fulfillment of conditions laid down in clauses [i] to [v] of sub-section (5) of section 80G of the I.T Act, 1961.

- This approval shall be valid in perpetuity with effect from A.Y. 2019-20 unless specifically withdrawn. The details and validity of the certificate is available @ office.incometaxindia.gov.in
- The Return of Income along with the Income & Expenditure Account, Receipts and Payments Account and Balance Sheet should be submitted annually to the Assessing Officer having jurisdiction over the case.
- No change in the Trust Deed/Memorandum of Association shall be effected without the prior approval of the undersigned i.e. **Commissioner of Income Tax (Exemptions), Chennai**.
- Every receipt issued to a donor shall bear the **Unique Registration Number** i.e. **URNo. AACTN7857J/05/18-19/T-1105/80G** and date of this order i.e. **10.04.2019**.
- Under the provisions of section 80G(5)(i)(a), the institution/fund registered u/s.12A, u/s.12AA(1)(b) or approved u/s.10(23C), 10(23C)(vi)(via), etc., shall have to maintain separate books of accounts in respect of any business activity carried on and shall intimate this office within one month about commencement of such activity.



Sd/-
(G.M.DOSS, I.R.S)
Commissioner of Income Tax (Exemptions)
Chennai.

Copy to:

- The applicant
- Guard File
- The DCIT(Exemptions) Coimbatore Circle.

//Certified True Copy//

(N. SRINIVASA RAO)
Assistant Commissioner of Income-tax (H.qrs)
(Exemptions), Chennai.

FORM NO. 10AC

(See rule 17A/11AA/2C)

Order for registration

1	PAN	AACTN7857J
2	Name	NATURE SCIENCE FOUNDATION
2a	Address	
	Flat/Door/Building	LIG-II, 2669
	Name of premises/Building/Village	GANDHIMAA NAGAR.
	Road/Street/Post Office	Coimbatore South
	Area/Locality	COIMBATORE
	Town/City/District	Gandhimasnagar S.O
	State	Tamil Nadu
	Country	INDIA
	Pin Code/Zip Code	641004
3	Document Identification Number	AACTN7857JE2021501
4	Application Number	739995830271021
5	Unique Registration Number	AACTN7857JE20215
6	Section/sub-section/clause/sub-clause/proviso in which registration is being granted	01-Sub clause (i) of clause (ac) of sub-section (1) of section 12A
7	Date of registration	03-11-2021
8	Assessment year or years for which the trust or institution is registered	From AY 2022-23 to AY 2026-2027
9	Order for registration:	
	a. After considering the application of the applicant and the material available on record, the applicant is hereby granted registration with effect from the assessment year mentioned at serial no 8 above subject to the conditions mentioned in row number 10.	
	b. The taxability, or otherwise, of the income of the applicant would be separately considered as per the provisions of the Income Tax Act, 1961.	
	c. This order is liable to be withdrawn by the prescribed authority if it is subsequently found that the activities of the applicant are not genuine or if they are not carried out in accordance with all or any of the conditions subject to which it is granted, if it is found that the applicant has obtained the registration by fraud or misrepresentation of facts or it is found that the assessee has violated any condition prescribed in the Income Tax Act, 1961.	
10	Conditions subject to which registration is being granted	
	The registration is granted subject to the following conditions:-	

	o. This certificate cannot be used as a basis for claiming non-deduction of tax at source in respect of investments etc. relating to the Trust/ Institution.
	p. All the Public Money so received including for Corpus or any contribution shall be routed through a Bank Account whose number shall be communicated to Office of the Jurisdictional Commissioner of Income Tax.
	q. The applicant shall comply with the provisions of the Income Tax Act, 1961 read with the Income Tax Rules, 1962.
	r. The registration and the Unique registration number has been instantly granted and if, at any point of time, it is noticed that form for registration has not been duly filled in by not providing, fully or partly, or by providing false or incorrect information or documents required to be provided under sub-rule (1) or (2) of rule 17A or by not complying with the requirements of sub- rule (3) or (4) of the said rule, the registration and Unique Registration Number (URN), shall be cancelled and the registration and URN shall be deemed to have never been granted or issued.
Name and Designation of the Registration Granting Authority	Principal Commissioner of Income Tax/ Commissioner of Income Tax (Digitally signed)



Certificates of Green Campus Auditors

1. ISO Environment Management System (14001:2015) of Mrs. S. Rajalakshmi, 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. Bureau of Energy Efficiency (BEE) and National Productivity Council of Er. N. Dineshkumar and Dr. N. Balasubramanian, Energy Auditors of NSF.



Certificate of Training

TNV hereby certifies that

S. Rajalakshmi

has successfully completed the 5 days

Auditor / Lead Auditor Training Course which meets the training requirements of the Exemplar Global and has been declared as competent in the following competency units

- EM: Environmental Management System
- AU: Management Systems Auditing
- TL: Leading Management Systems Audit Teams

ISO 14001:2015

Issue Date: 17th Jun. 2021

Training Date : 20th to 24th May. 2021

Certificate Number : 2106170721010105

Authorised Signatory
(Pragyesh Singh)

This course is certified by Exemplar Global vide registration number TN006669

Note: The course conforms to the principles and practice of audits of Management Systems for compliance with standards. This certificate remains the property of TNV and this certificate is recognized by Exemplar Global. For verification of this certificate, please write to Mail: info@isoindia.org



**PR315: ISO 14001:2015 Lead Auditor
(Environmental Management Systems)
Training course**

Certificate of Achievement

Geethakarathi Alagarsamy

has successfully completed the above mentioned course and examination.

23rd - 27th March 2019

COIMBATORE, INDIA

Certificate No. 35242817 02

Delegate No. 171136

A handwritten signature in black ink, appearing to be "G. Alagarsamy".

for TÜV NORD CERT GmbH

Essen, 2019-04-26

The course is certified by CQI and IRCA (Certification No. 18125). The learner meets the training requirements for those seeking certification under the IRCA EMS Auditor certification scheme.

TÜV NORD CERT GmbH

Langemarckstraße 20

45141 Essen

www.tuev-nord-cert.com







Medicinal Plants Farmes 1999-2000
 Kuppayee Thottam, Vadugampalayam Privu,
 Gobi.

ATTENDANCE CERTIFICATE
FOR INSITUTIONAL TRAINING

This is to Certify that Mr. **D. VINOTHKUMAR**
 of **B.Sc., BOTANY FINAL YEAR** of
 Chikkaiah Naicker College, Erode-4. Has undergone institutional training in Plantation, Cultivation
 and Collection of medicinal plants for 14 days from **18.12.99** to
31.12.99 at Gobi.

Station : GOBI
 Date : 31.12.99

M. R. SARAVANAN, SCIENTIST
HERBAL
GOBI-638476

m. m. r. Saravanan
 SIGNATURE OF THE CONCERNED AUTHORITY
M. R. SARVANAN, GOBI



BUREAU OF ENERGY EFFICIENCY



Examination Registration No. : **EA-14056** Serial Number **9176**

Certificate Registration No. : **9176**

Certificate For Certified Energy Manager

This is to certify that Mr./Mrs./Ms. **Dinesh Kumar D** Son/Daughter of Mr./Mrs. **R M Dhanasekaran** who has passed the National Examination for certification of energy manager held in the month of **October 2011** is qualified as certified energy manager subject to the provisions of Bureau of Energy Efficiency (Certification Procedures for Energy Managers) Regulations, 2010.

This certificate shall be valid for five years with effect from the date of award of this certificate and shall be renewable subject to attending the prescribed refresher training course once in every five years.

His /Her name has been entered in the Register of certified energy manager at Serial Number **9176** being maintained by the Bureau of Energy Efficiency under the aforesaid regulations.

Mr./Mrs./Ms. **Dinesh Kumar D** is deemed to have qualified for appointment or designation as energy manager under clause (f) of Section 14 of the Energy Conservation Act, 2001 (Act No.52 of 2001).

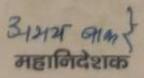
Given under the seal of the Bureau of Energy Efficiency, this **7th** day of **February, 2013**

Secretary
Bureau of Energy Efficiency
New Delhi

Digitally Signed: RAKESH KUMAR RAI
Sun Mar 01 10:58:55 IST 2020
Secretary, BEE New Delhi

Dates of attending the refresher course	Secretary's Signature	Dates of attending the refresher course	Secretary's Signature
22.12.2019			

Regn. No. EA-7391		Certificate No. 5093
National Productivity Council (National Certifying Agency)		
<u>PROVISIONAL CERTIFICATE</u>		
<i>This is to certify that Mr. / Ms. <u>N. Balasubramaniam</u></i>		
<i>son / daughter of Mr. <u>M. Nanjukkuttigounder</u></i>		
<i>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.</i>		
<i>He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.</i>		
<i>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.</i>		
<i>This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.</i>		
Place : Chennai, India		
Date : 11 th February 2010		Controller of Examination

	
ऊर्जा दक्षता ब्यूरो BUREAU OF ENERGY EFFICIENCY	
विद्युत मंत्रालय, भारत सरकार MINISTRY OF POWER, GOVERNMENT OF INDIA	
प्रमाणित किया जाता है कि	
श्री/श्रीमती <u>दिनेश कुमार</u> ने ऊर्जा संरक्षण भवन निर्माण संहिता के लिए <u>7 दिसंबर '16</u> से <u>8 दिसंबर '16</u> तक एमएनआईटी / सीईपीटी / आईआईआईटी द्वारा आयोजित मास्टर ट्रेनर सर्टिफिकेट कार्यक्रम को सफलता पूर्वक सम्पन्न कर लिया है।	
This is to certify that	
Shri/Smt. <u>Dinesh Kumar</u> has successfully completed the Master Trainer Certificate Programme conducted by MNIF / GEPT / IIIT from <u>7 December '16</u> to <u>8 December '16</u> for the Energy Conservation Building Code.	
New Delhi, <u>07 JUL 2017</u>	 महानिदेशक Director General

	<p>GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT</p> <p>DINESH KUMAR D</p> <p>HAS ATTAINED THE DESIGNATION OF</p> <p>LEED AP[®] Building Design + Construction</p> <p>by demonstrating the knowledge and understanding of green building practices and principles needed to support the use of the LEED[®] green building program.</p>
<p>10531234-AP-BD+C</p> <hr/> <p>CREDENTIAL ID</p> <p>26 DEC 2016</p> <hr/> <p>ISSUED</p> <p>25 DEC 2022</p> <hr/> <p>VALID THROUGH</p>	<p></p> <hr/> <p>MAHESH RAMARAJAN PRESIDENT & CEO, U.S. GREEN BUILDING COUNCIL PRESIDENT & CEO, GREEN BUSINESS CERTIFICATION INC.</p>

	
<p>GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT</p>	
<p>GRIHA CERTIFIED PROFESSIONAL CERTIFICATE</p>	
<p>This is to certify that</p>	
<p><u><i>Dinesh Kumar Dhanasekaran</i></u></p>	
<p>has qualified as a GRIHA Certified Professional For V. 2015</p>	
<p>Date of issue: 19th June 2020 Note : This certification is valid only for GRIHA version 2015.</p>	<p> Chief Executive Officer GRIHA Council</p>