

# TECHNICAL REPORT OF GREEN CAMPUS AUDIT



*Submitted to*

**NIRMALA COLLEGE OF PHARMACY,  
MUVATTUPUZHA  
ERNAKULAM DT, KERALA - 686 661, INDIA**

*Date of Audit: 26.07.2023*

*Valid till: 27.07.2025*

*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 CO<sub>2</sub> 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). 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; Rajalakshmi *et al.*, 2022).

## 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 issues (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. 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. 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 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 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.
- 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 (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. 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 National Building Code 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
- 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.
- 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 of 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.
- Operation of water irrigation methods such as drip and sprinkler irrigation to improve the effective usage of water.
- 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, ornamental, economic and food values of plant varieties.
- MoU may be signed with Government and non-Governmental Organizations 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.
- 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.
- 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.
- 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 eco-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 the campus atmosphere.

## **8. About the Organization**

### **8.1. Nirmala College of Pharmacy (NCP)**

Nirmala College of Pharmacy (NCP) is yet another hallmark of the commitment and experience of the catholic diocese of Kothamangalam in the field of education. NCP is a christian minority institution established in 2004 as a memorial of the diocesan golden jubilee. It is managed by the Catholic diocese of Kothamangalam under Nirmala College Society. (Reg. No. ER.928/2001). At present the college is affiliated to Kerala University of Health Sciences, Thrissur. This college is approved by Govt. of Kerala and Pharmacy Council of India (PCI), New Delhi. The college aims at the formation of students with academic excellence coupled with integrity of character.

It provides excellent infrastructural facilities with all modern amenities, a dedicated and experienced faculty with a vision to develop the institution into a full - fledged pharma-research centre. Mar George Madathikandathil, Bishop of Kothamangalam is the Patron and Rev. Dr. Msgr. Pius Malekandathil is the President. The foundation stone of the college was laid by Mar George Punnakottil, the Patron on 19th March 2004. The College was inaugurated by Sri. Vayalar Ravi, Union Cabinet Minister for Overseas Affairs on 15th March 2009. The New block of the college was blessed by Mar. George Madathikandathil, Bishop of Kothamangalam diocese and inaugurated by Sri. P.J. Joseph Honourable Minister for Water Resources on 22nd May 2015. U.G Pharmacy



course is accredited by NBA till 2025.

**Table 1. The Nirmala College of Pharmacy campus facility details**

S.No.	Details of Area	Total area
1.	Total Campus area	25.25 Acres
2.	Total Built up area	8254.03 m <sup>2</sup>
3.	Forest vegetation	30%
4.	Planted vegetation	65%

## 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 29<sup>th</sup> 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 (Table 2).

**Table 2. 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"> <li>• GBCRS - Green Building Code and Green Ratings Systems</li> <li>• GRIHA – Green Rating for Integrated Habitat Assessment</li> </ul>	<ul style="list-style-type: none"> <li>➤ Dr. S. Rajalakshmi</li> <li>➤ Dr. R. Mary Josephine</li> <li>➤ Dr. B. Mythili Gnanamangai</li> <li>➤ Er. N. Shanmugapriyan</li> </ul>
Energy Audit	<ul style="list-style-type: none"> <li>• BEE - Bureau of Energy Efficiency</li> <li>• LEED - Leadership in Energy and Environmental Design</li> <li>• CII-GreenCo – GreenCo Rating System</li> </ul>	<ul style="list-style-type: none"> <li>➤ Er. D. Dinesh kumar</li> <li>➤ Er. N. Shanmugapriyan</li> <li>➤ Dr. N. Balasubramaniam</li> <li>➤ Dr. P. Thirumoorthi</li> <li>➤ Dr. G. Murugananth</li> </ul>





	Felicitor	
Environment Audit	<ul style="list-style-type: none"> <li>• ASSOCHAM - Associated Chambers of Commerce and Industry of India</li> <li>• FSRS – Fire Safety &amp; Rescue Services</li> </ul>	<ul style="list-style-type: none"> <li>➤ Dr. S. Rajalakshmi</li> <li>➤ Dr. A. Geetha Karthi</li> <li>➤ Dr. R. Mary Josephine</li> <li>➤ Dr. B. Mythili Gnanamangai</li> <li>➤ Er. N. Shanmugapriyan</li> </ul>
Hygiene Audit	<ul style="list-style-type: none"> <li>• FSMS – Food Safety Management System</li> <li>• Occupational Safety &amp; Health (ISO 22000:2018)</li> <li>• SBICM - Swatch Bharath under India Clean Mission</li> </ul>	<ul style="list-style-type: none"> <li>➤ Mrs. Gaanaappriya Mohan</li> <li>➤ Dr. R, Sudhakaran</li> <li>➤ Dr. N. Saranya</li> </ul>
Waste Management Audits	<ul style="list-style-type: none"> <li>• Water &amp; Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit as per the Checklist of NSF</li> </ul>	<ul style="list-style-type: none"> <li>➤ Mrs. Gaanaappriya Mohan</li> <li>➤ Dr. R, Sudhakaran</li> <li>➤ Er. N. Shanmugapriyan</li> </ul>
ISO Certification	<ul style="list-style-type: none"> <li>➤ QMS (9001:2015),</li> <li>➤ EMS (14001:2015),</li> <li>➤ OHS (45001: 2018),</li> <li>➤ ISMS (27001:2018),</li> <li>➤ FSMS (22000:2018),</li> <li>➤ QMSMD (13485: 2016),</li> <li>➤ EnMS (50001: 2018)</li> </ul>	<ul style="list-style-type: none"> <li>➤ Dr. S. Rajalakshmi</li> <li>➤ Dr. A. Geetha Karthi</li> <li>➤ Mrs. Gaanaappriya Mohan</li> <li>➤ Dr. R. Mary Josephine</li> </ul>

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.



## 9. Audit Details

<b>Date / Day of Audit</b>	<b>: 26.07.2023</b>
<b>Venue of Audit</b>	<b>: Nirmala College of Pharmacy, Muvattupuzha, Kerala - 686 661, India</b>
<b>Audited by</b>	<b>: Nature Science Foundation, Coimbatore, Tamil Nadu, India.</b>
<b>Audit type</b>	<b>: Environment Audit</b>
<b>Name of the Auditing Chairman</b>	<b>: Dr. S. Rajalakshmi, ISO QMS, EMS, OHSMS and EnMS Auditor Founder &amp; Chairman of NSF</b>
<b>Name of the Auditing Team Leader</b>	<b>: Dr. D. Vinoth Kumar, ISO QMS, EMS and EnMS Auditor Joint Director of NSF.</b>
<b>Name of the Lead Auditor</b>	<b>: Er. D. Dinesh Kumar, Certified BEE, IGBC, ASSOCEM, GRIHA &amp; LEED Auditor</b>
<b>Name of the Energy Auditor</b>	<b>: Dr. N. Balasubramanian, Bureau of Energy Efficiency</b>
<b>Name of Subject Expert</b>	<b>: Mr. B.S.C. Naveen Kumar, Senior Faculty, Mahatma Gandhi National Council of Rural Education, Ministry of Higher Education, Hyderabad.</b>
<b>Name of the Eco Auditor</b>	<b>: Er. S. Srinivash, Tamil Nadu Fire and Rescue Services, Coimbatore.</b>
<b>Name of Eco &amp; Green Officer</b>	<b>: Ms. R. S. Thulaja, ISO QMS and EMS Auditor Programme Officer of NSF.</b>

## 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](http://www.nsfonline.org.in)) through the authenticated Professionals for people qualified to investigate and evaluate the campus for validating the best environmental practices. Professional team of ISO Environment Management Audit (14001:2015), Indian Green Building Council Accredited Professionals, Experts of Green campus Lead Auditors and Botanists / Zoologists / Biotechnologists were selected to conduct the Green campus audit process.

During the audit, the nature of plants and animals / birds species 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.

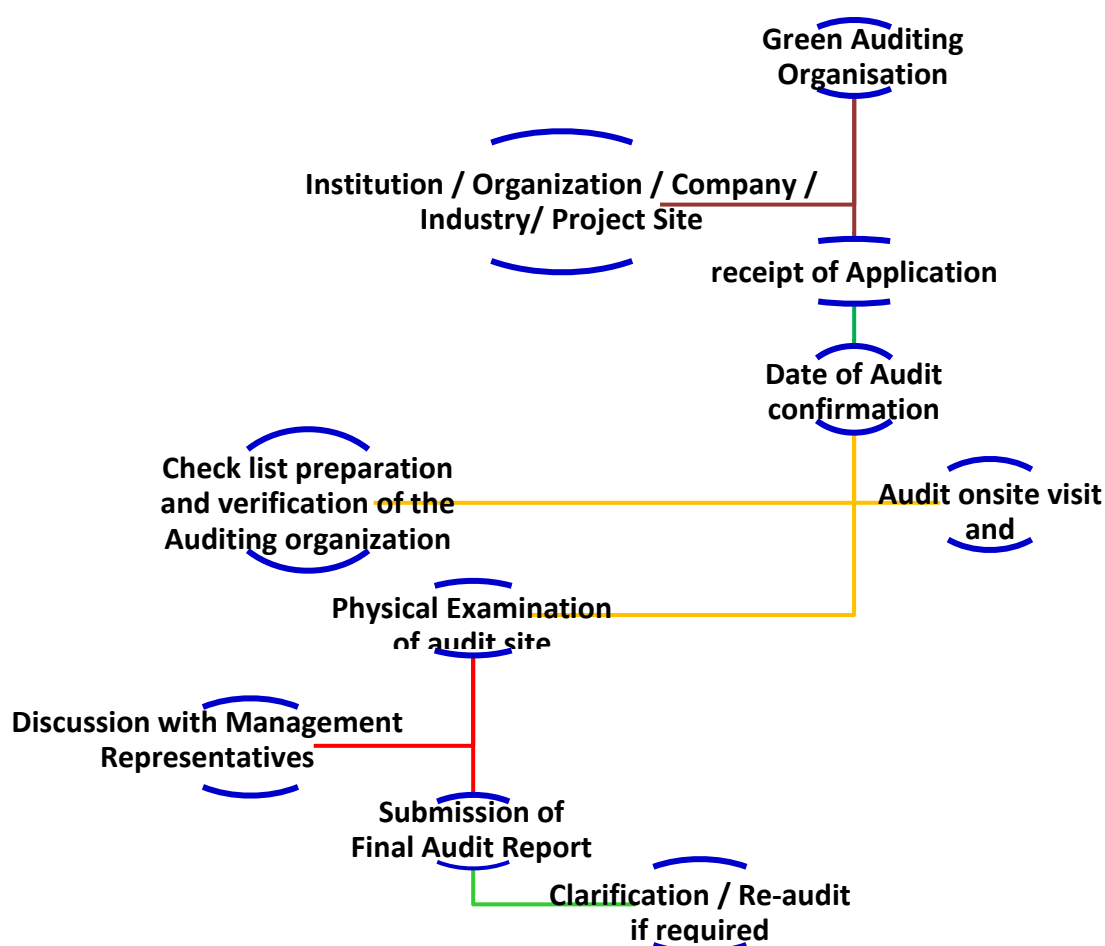
Attempts made for water scarcity during summer season towards the maintenance of plants and frequency of watering for plantations in the campus were noted. Biodiversity conservation education, projects, awareness programmes, etc., through Indian Biodiversity Act and Ministry of Environment, Forests and 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. 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 scrutiny 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. Pre-Audit stage activities

A pre-audit meeting (opening meeting) is conducted with Management and Administrative people along with staff coordinators of Green campus 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 National Building Code and Associated Chambers of Commerce and Industry of India, New Delhi.

**Plate 1. Opening meeting with the Principal, IQAC Coordinator and Management Responsibilities of the Nirmala College of Pharmacy and Audit Team of the Nature Science Foundation**



### 10.2. 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 campus and required photographs were taken then and there for preparing the audit report.
3. During the onsite visit, it is vivid how the various facilities made by the Management of the Institution 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.



Plate 2.



### 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 areas listed in the Green audit process in which a few are taken into consideration as per the Indian scenario. 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 besides rain harvesting system



## 10.4. Flora and Fauna diversity of study area



The Nirmala College of Pharmacy is located in Muvattupuzha District, Kerala, India. At present, the campus is quite clean, green and with much less pollution when compared to the rest of the city. Dicot and monocot plants can be found on the campus considerably. In contrast, the campus is harboured to a wide variety of birds and animals.

### 10.4.1. Geology, Topography and Soil condition

A major part of the district falls in the hill ranges of Western Ghats except for Thodupuzha block and western part of Elamdesam block which fall in the mid land region of the State. The average elevation of the mid land region ranges from 40 – 60 m amsl. The mid land area is characterized by rugged topography formed by small hillocks separated by deep valleys. The general slope of the area is towards west. The hill ranges can be subdivided into foot hills, plateau region and high ranges. The foot hill region is a narrow strip of land where midland region grades into the plateau regions. The elevation of this region ranges from 80 to 500 m amsl and slope is very steep, ranging from 30 to 50% and occasionally up to 80%. The width of the foot hill ranges from 2 to 8 km. Plateau region is the most important physiographic unit of the district and is characterized by moderately sloping large land mass with a slope of less than 30% and an elevation of less than 1500 m amsl. Major part of the district fall in this region. The region is incised by a number of deep cut streams. The area in the north eastern part of the district is characterized by high mountains with elevation more than 1500 m amsl. The highest peak in South India, Anamudi (2693 m amsl) is in the north central part of the district. There are several steep falls within the region.

There are four major soil types encountered in the district. They are forest loams, lateritic soils, brown hydromorphic soils and alluvial soils. About 60 % of the district is covered under forest loams which are the product of weathering of the rock under forest cover. They are characterized by a surface layer very rich in organic matter. They are generally acidic, high in nitrogen and poor in bases, due to heavy leaching. They are dark reddish brown to black with loamy to silty loam texture. In denuded areas



leaching and deposition of humus in the lower layer is common. The lateritic soils are derived from laterites and are encountered mainly in Elamdesam and Thodupuzha blocks of the district. They are well-drained and are low in plant nutrients and organic matter. The fertility of the soil is generally poor with low available nitrogen and phosphorous. Brown hydromorphic soils are confined to valley portions in undulating terrain. These soils are formed as a result of transportation and sedimentation of materials from adjoining hill slopes and are brownish black in colour. The surface texture varies from sandy loam to clay. Alluvial soils are seen as narrow strips along the banks of rivers in the district. They are more common along the banks of Thodupuzha River. The surface texture of these soils' ranges from sandy loam to clay and they are fertile. (Table.3)

**Table 3. Soil edaphic and environmental parameters of the Campus**

S.No	Details of Parameters	Data collected
<b>Soil edaphic parameters</b>		
1.	Soil pH	7 – 8.5
2.	Soil types	Alluvial and forest loams
3.	Total organic carbon	11%
4.	Electrical conductivity	8 dSm <sup>-1</sup>
5.	Water holding capacity	80%
6.	Total Nitrogen	8 ppm
7.	Available Phosphorous	7 ppm
8.	Exchangeable Potassium	3 ppm
<b>Environmental parameters</b>		
1.	Minimum Temperature	23°C
2.	Maximum Temperature	33°C
3.	Minimum Relative humidity	50%
4.	Maximum Relative humidity	78%
5.	Annual Average Rainfall	700 mm/avg.year
6.	Annual Average Sunshine	7.27 hrs/day
7.	Wind speed	16 miles/h

#### 10.4.2. Climatic conditions

The climatic conditions in the mid lands, plateau regions and hill ranges of the district have wide variations. Since all these regions do not have full-fledged climatic stations, the details at Pampadumpara station (Plateau region) maintained by Kerala Agricultural University are furnished below.

- The temperature is more during the months of March to May and is less during January and February. The average monthly maximum temperature ranges from 25.1 to 31.50 C and minimum temperature from 18.6 to 14.00 C.



- The relative humidity is more during the morning hours and is less during evening hours. During morning hours it ranges from 85.0 to 98.45% and during evening hours it ranges from 40.8 to 87.3%.
- Evaporation is more during summer months of March to May. In general it ranges from 1.11 to 5.0 mm/day. During the south west monsoon it ranges from 1.11 to 2.13 mm/day.
- Sunshine ranges from 1.8 to 9.5 hrs/day. Maximum sunshine is during the month of February. The months of June to August record the minimum sunshine due to cloudy sky. Generally good sunshine hours are recorded in the months of December to May.
- The wind speed ranges from 3.90 to 7.95 km/hour. The wind speed is high during the months of March to July and November to January.

## **11. Identification of Plant Species**

### **11.1. Identification of Flowering Plant Species**

Various vascular plant species were collected across the campus and subjected to botanical identification (botanical name, family, habitat, and economic importance) and anthropogenic disturbances to the natural vegetation in the campus. Plants were freshly collected and their digital photographs were also taken. The collected plant specimens have been identified using “The Flora of the Tamil Nadu Carnatic” (Matthew, 1983). Further, their identification was confirmed by matching with authentic specimens in the Botanical Survey of India (BSI), Southern Circle, Coimbatore, Tamil Nadu, and India.

### **11.2. Identification of Non-Flowering Plant Species**

#### **11.2.1. Lichen Identification**

Lichen specimens were collected from the 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. 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).

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



spots, sometimes fused as bars, running along back with black line running through eye are recorded. Males typically grey with a black zigzag stripe, females generally brown with a dark brown zigzag stripe (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 while auditing. 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 4. Qualitative Measurements of Green Auditing

S. NO.	Part 11 clause as per National Building Code	Audit Checklist with weightage	Response	
			Yes	No
1.	6.2.4. Reduced Building footprint in Multi-storeyed Building designs	Maintenance of 30% of open spaces as softscapes (Vegetative area) its gross total area appropriately.	✓	
2.	7.1.1. Landscape design	If any landscaping activities to reduce the carbon by planting trees and other vegetation.	✓	
3.	7.1.1.2. External Noise reduction / mitigation practices	Assessing the appropriate measures taken for reducing noise level like quieter pavement (Traditional Method), earth berms (raised barrier made up of compacted soil)	✓	
4.	7.1.13. Building shadow	What are energy consumption activities performed <i>via</i> vegetation?	✓	



	considerations on landscapes			
5.	7.1.3.1.Preserving Top Soil	Reviewing on whether the site follows healthy soil maintenance (soil test, use of vermicompost, organic/green manure)	✓	
6.	7.1.3.2. Ecological Design / Conserving biodiversity	Whether the transplantation of matured trees is followed in the case of vegetation clearing is necessary for construction.	✓	
7.		Use of vegetation that promotes regional identity (native plants) and a sense of place (geographical condition).	✓	
8.		Action plan for conservation of native endangered species through awareness programmes and demonstrations.	✓	
9.		Are any biofertilizers, organic manures, farmyard manures, vermicompost, green manures are applied to avoid the use of chemical fertilizers for maintaining plants?		✓
10.		Sufficient number of trees, shrubs, herbs and lawns available in the campus	✓	
11.		Projects and Dissertation works and Scholarly publications related to flora and fauna by students, scholars and staff members – specify & show the records.	✓	
12.	7.1.3.4. Vertical Landscaping and roof system	Whether the campus had roof/kitchen/zodiac/ornamental/medicinal garden/ and green walls or vertical landscaping (vertical garden)	✓	
13.	7.3.2. Water Conservation and Irrigation Purposes	Availability of water drip and sprinkler irrigation systems in the campus to reduce the operation costs under energy and water conservation methods		✓
14.	9.1.2. Minimizing Green House Gas (GHG) Emission	What are the alternative materials, methods that considerably reduce energy and CO <sub>2</sub> emissions (Indoor plants)	✓	
15.		Oxygen and carbon di oxide levels in the campus atmosphere will be measured using oxygen and carbon di oxide meters at the time of onsite audit.	✓	

### 13.2. Table 5. Quantitative Measurements of Green Auditing

S.No.	Details of Plant and Animal species	Numbers
1.	Total number of Flowering plant species inside the Campus	160 species belonging to 90 Genera under 60 families
2.	Total number of Non-Flowering plant species inside the Campus	05 species belonging to Lichens, Pteridophytes,



		Bryophytes and Mycoflora
3.	Total number of living Animals inside the Campus	05 such as Cats, Mice and Dog
4.	Total number of visiting Animals inside the Campus	10 Species belonging Rabbit, Squirrel and Monkey
5.	Total number of living Birds inside the Campus	20 species belonging Common Myna, House Sparrow, King- crow, House Crow, Jungle Babbler, , Honey bird
6.	Total number of visiting Birds inside the Campus	20 species belonging Mangrove heron, Common Wood shrike, Peacock.
7.	Total number of Aquarium	-
8.	Total number of Aquatic (hydrophytes) plant species	-
9.	Percentage of Forest Vegetation	30%
10.	Percentage of Planted Vegetation	65%
11.	Percentage of Water consumption to total human population	NA
12.	Percentage of Water consumption to total flora and fauna	NA

### 13.3 Flora and Fauna diversity in the Campus

#### 13.3.1. Flora diversity in the Campus

##### 13.3.1.1. Flowering plants diversity in the 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 campus has more than 35-45% of wild, 50-60% native plant species and the other 30-35% 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 45% of the wild traits are leveraged for the native animals and birds. The most probable natural vegetation of campus is the dry deciduous type. The remnants of this past vegetation are found in the campus

The most plants recorded are mangifera indica L., Java Plum, *Azadirachta indica* A. Juss., *Tamarindus indica*, *Pongamia pinnata*, *Cassia fistula*, which are dominant trees species characteristic to the vegetation within the campus. Some of the shrub



species like *Solanum melongena*, *Plumeria alba*, *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 *Euphorbia hirta* L., is found to be predominant. Species such as *Catharanthus roseus*, *Cynodon dactylon* are some common herbs in the campus.

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

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

Most of the species found are common in the campus, some of the species *Cucumis dipsaceus* Ehrenb, *Hybanthus*, and *Caralluma bicolor* Ramach., is the rare species. Some endemic grass species like *Andropogon pumilus* Roxb., *Panicum psilopodium* Trin., and *Perotis indica* (L.) Kuntze 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 Wild tamarind *Leucaena leucocephala* L., This is clearly indicated disturbances to the natural setting in the vegetated areas.

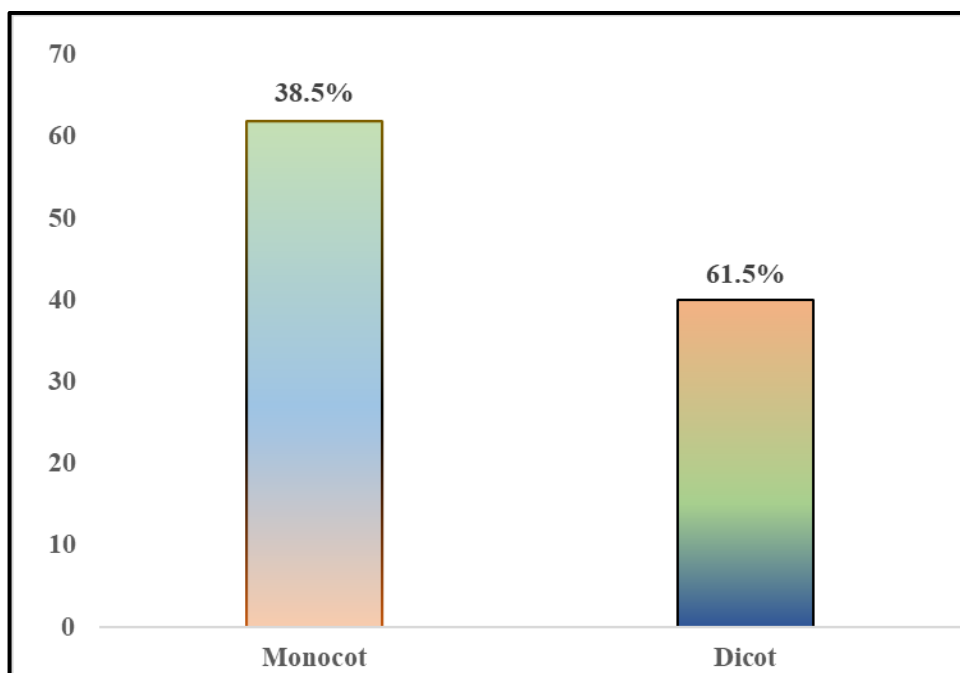
The alien / exotic species viz., *Plumeria*, *Anthurium* and *Tecoma stans* (L.) Kunth are occur in the campus.

Some of the species are utilized as fruit yielding like *Mangifera indica* L. (Maa), *Psidium guajava* L., (Koyya), Java plum, *Cucumis sativus*, *Phyllanthus emblica* L. (Nelli), *Artocarpus heterophyllus* (Jack fruit), *Phyllanthus acidus* (Amla) and Species such as *Bougainvillea glabra*, *Ixora coccinea* are exploited for their attractive flowers.

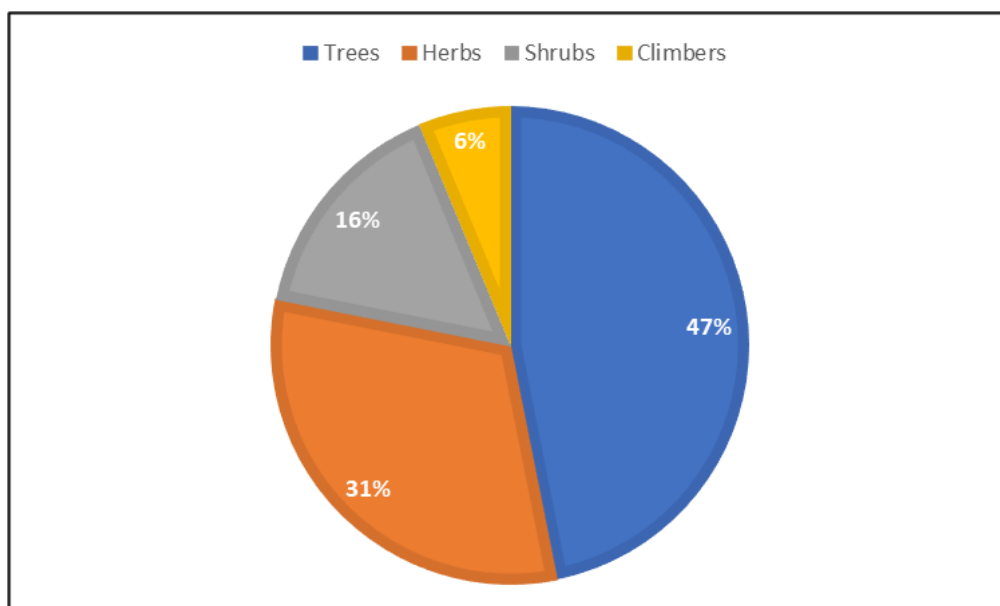
The biodiversity of Nirmala College of Pharmacy campus comprises a sum of 160 species belonging to 90 genera under 60 families besides the lichens, mycoflora, pteridophytes and bryophytes (Plate 1, 2 & 3). Among the documented higher plants, Dicots are dominating with 61.5 families followed by monocots (38.5 families)(Fig.1) Over all analysis revealed that trees were dominating flora (47%) followed by herbs, shrubs and climbers which accounts 31%, 16 % and 6 %, respectively (Fig.2). Poaceae is first dominant family and followed, fabaceae, Euphorbiaceae, Lamiaceae, Acanthaceae, Apocyanaceae and Rutaceae with 15, 12, 8, 7, 6, 5 and 4 species respectively (Fig.3). At the time of green campus audit at Nirmala College of Pharmacy Campus, a total of 1 invasive floral species were recorded. This clearly specified the disturbances to the natural setting in the vegetated sector.



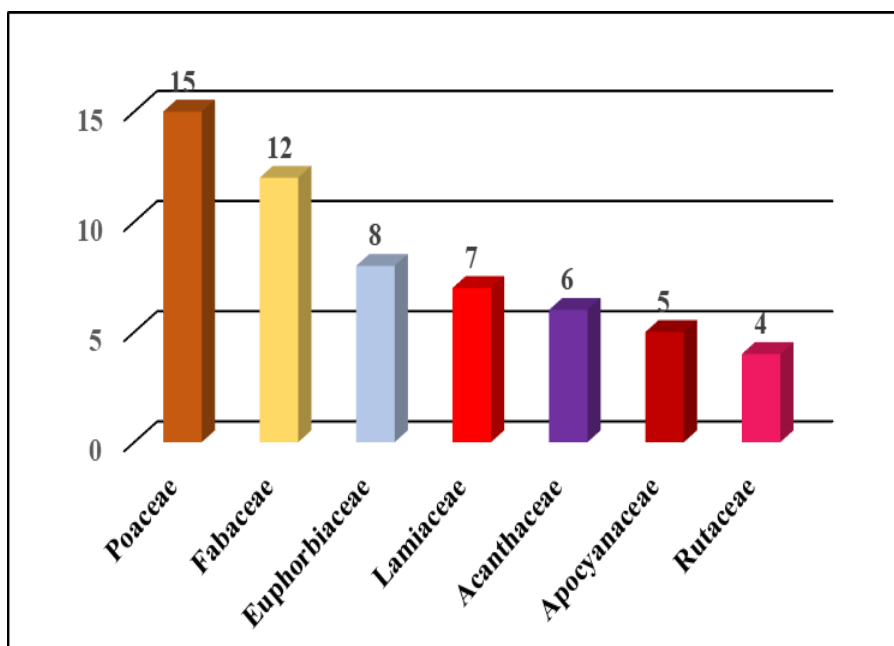
**Fig.1. Systematic groups of the plants in the campus**



**Fig.2. Analysis of habit-wise distribution of plant species in the campus**





**Fig.3. Plant families with higher number of species in the campus area****Table 6. List of Flowering plants in the Campus**

S.No	Common Name	Scientific Name	Family	Habitat
1.	Monkey Bush	<i>Abutilon Indicum</i>	Malvaceae	Herbs
2.	Black Wattle	<i>Acacia Mangium</i>	Leguminosae	Tree
3.	Copper Leaf	<i>Acalypha Wilkesian</i>	Euphorbiaceae	Shrub
4.	Knot Grass	<i>Aerva Lanata</i>	Amaranthaceae	Herb
5.	Goat Weed	<i>Ageratum Conyzoides</i>	Asteraceae	Herb
6.	White Siris	<i>Ailanthus Integrifolia</i>	Simaroubaceae	Tree
7.	Cake Tree	<i>Albizia Amara</i>	Fabaceae	Tree
8.	Aloe Vera Sis	<i>Aloe Barbaden</i>	Liliaceae	Shrub
9.	Sessile Joyweed	<i>Alternanthera Sessilis</i>	Amaranthaceae	Herb
10.	Spiny Amaranth	<i>Amaranthus Spinous</i>	Amaranthaceae	Herb
11.	Slender Amaranth	<i>Amaranthus Viridis</i>	Amaranthaceae	Herb
12.	Annual Ragweed	<i>Ambrosia Artemisiifolia</i>	Compositae	Herb
13.	False Indigo Bush	<i>Amorpha Fruiticosa</i>	Fabaceae	Shrub
14.	Cashew Nut	<i>Anacardium Occidentale</i>	Anacardiaceae	Tree
15.	King Of Bitters	<i>Andrographis Paniculata</i>	Acanthaceae	Herb
16.	Beard Grass	<i>Andropogon Pumilus</i>	Acanthaceae	Herb
17.	Soursop	<i>Annona Muricata</i>	Annonaceae	Tree
18.	Soursop	<i>Annona Muricata L.</i>	Annonaceae	Tree
19.	Custard Apple	<i>Annona Reticulata</i>	Annonaceae	Tree
20.	Flamingo Flower	<i>Anthurium Andraeanum</i>	Araceae	Herb

21.	Monkey Puzzle Tree	<i>Araucaria Araucana</i>	Araucariaceae	Tree
22.	Oosi Pullu	<i>Aristida Adscensionis</i>	Poaceae	Herb
23.	Common Needle Grass	<i>Aristida Pinnata</i>	Poaceae	Herb
24.	Asparagus	<i>Asparagus Officinalis</i>	Asparagaceae	Herb
25.	Ganges Primrose	<i>Asystasia Gangetica</i>	Acanthaceae	Herb
26.	Jack Fruit	<i>Atrocarpus Heterophyllus</i>	Moraceae	Tree
27.	Neem Tree	<i>Azadiracta Indica</i>	Meliaceae	Tree
28.	Bamboo	<i>Bambusa Vulgaris</i>	Poaceae	Tree
29.	Butterfly Tree	<i>Bauhinia Purpurea</i>	Fabaceae	Tree
30.	Toddy Palm	<i>Borassus Flabellifer</i>	Arecaceae	Tree
31.	Paper Flower	<i>Bougainvillea Glabra Choisy</i>	Nyctaginaceae	Climber
32.	Great Bougainvillea	<i>Bougainvillea Spectabilis</i>	Nyctaginaceae	Tree
33.	Devil's Backbone	<i>Bryophyllum Daigremontianum</i>	Cassulaceae	Herb
34.	Flame of the Forest	<i>Butea Monosperma</i>	Fabaceae	Tree
35.	Flame of the Forest	<i>Butea Monosperma</i>	Fabaceae	Tree
36.	Peacock Flower	<i>Caesalpinia Pulcherima</i>	Caesalpinaceae	Shrub
37.	Surinamese Stick	<i>Calliandra Surinamensis</i>	Leguminosae	Tree
38.	Red Powder Puff	<i>Calliandra Haematocephala</i>	Fabaceae	Tree
39.	Alexandrian Laurel Balltree	<i>Calophyllum Inophyllum</i>	Calophyllaceae	Tree
40.	Dogbane	<i>Calotrophis Gigantea</i>	Apocynaceae	Shrub
41.	Indian Shot	<i>Canna Indica</i>	Cannaceae	Herb
42.	Papaya	<i>Carica Papaya</i>	Caricaceae	Tree
43.	Wine Palm	<i>Caryota Urens</i>	Areaceae	Tree
44.	Golden Shower	<i>Cassia Fistula L.</i>	Fabaceae	Tree
45.	Bright Eyes	<i>Catharanthus Roseus L.</i>	Apocynaceae	Herb
46.	Brazilian Bachelor's Button	<i>Centratherum Punctatum</i>	Asteraceae	Herb
47.	Swollen Finger Grass	<i>Chloris Barbata</i>	Poaceae	Herb
48.	Ceylon Satinwood	<i>Chloroxylon Switenia</i>	Rutaceae	Tree
49.	Chondro Mollika	<i>Chrysanthemum Grandiflorum</i>	Compositae	Shrub
50.	Lemon	<i>Citrus Limon (L.) Osbeck</i>	Rutaceae	Shrub
51.	Pummelo	<i>Citrus Maxima</i>	Rutaceae	Tree
52.	Asian Spider Flower	<i>Cleome Viscosa</i>	Capparaceae	Herb
53.	Aparajita Climbing Vine	<i>Clitoria Ternatea</i>	Fabaceae	Climber
54.	Cocunut	<i>Cocos Nucifera L.</i>	Areaceae	Tree
55.	Variegated Croton	<i>Codiaeum Variegatum</i>	Euphorbiaceae	Shrub
56.	Buffalo Calf Plant	<i>Combretum Albidum</i>	Combretaceae	Climbers
57.	Indian Cherry	<i>Cordia Dichotoma</i>	Boraginaceae	Tree
58.	Broadleaf Palm-Lily	<i>Cordyline Fruticosa</i>	Asparagaceae	Shrub
59.	Corriander	<i>Coriandrum Sativum L.</i>	Apiaceae	Herb

60.	Purging Croton	<i>Croton Tiglium</i>	Euphorbiaceae	Shrub
61.	Purging Croton	<i>Croton Tiglium</i>	Euphorbiaceae	Shrub
62.	Rubber Vine	<i>Cryptostegia Grandiflora</i>	Apocynaceae	Shrub
63.	Mexican Heather	<i>Cuphea Hyssopifolia</i>	Lythraceae	Shrub
64.	Mexican Heather	<i>Cuphea Hyssopifolia</i>	Lythraceae	Shrub
65.	Cycas	<i>Cycas Beddomei</i>	Cycadaceae	Tree
66.	Queen Sago	<i>Cycas Circinalis L.</i>	Cycadaceae	Tree
67.	Cycas	<i>Cycas Indica</i>	Cycadaceae	Tree
68.	King Sago	<i>Cycas Revoluta</i>	Cycadaceae	Tree
69.	Palm Rose	<i>Cymbopogon Martimii</i>	Poaceae	Herb
70.	Scutch Grass	<i>Cynodon Dactylon L.</i>	Poaceae	Herb
71.	Annual Sedge	<i>Cyperus Compresses</i>	Cyperaceae	Herb
72.	Coco-Grass	<i>Cyperus Rotundus</i>	Cyperaceae	Herb
73.	Indian Rose Wood	<i>Dalbergia Latifolia</i>	Fabaceae	Tree
74.	Indian Rosewood	<i>Dalbergia Sissoo</i>	Leguminosae	Tree
75.	Vadanarayanan,	<i>Delonix Elata</i>	Caesalpiniaceae	Tree
76.	Gulmohar	<i>Delonix Regia</i>	Leguminosae	Tree
77.	Male Bamboo	<i>Dendrocalamus Strictus</i>	Poaceae	Tree
78.	Snake Plant	<i>Dracaena Trifasciata</i>	Asparagaceae	Shrub
79.	Golden Dewdrops	<i>Duranta Erecta L.</i>	Verbenaceae	Shrubs
80.	Areca Palm	<i>Dypsis Lutescenes</i>	Arecaceae	Tree
81.	Golden Cane Palm	Dypsis Lutescens	Arecaceae	Tree
82.	Fasle Daisy	<i>Eclipta Prostrata</i>	Asteraceae	Herb
83.	Yard-Grass	<i>Eleusine Indica</i>	Poaceae	Herb
84.	Money Plant	<i>Epipremnum Aureum</i>	Araceae	Climber
85.	Dragon-Tail	Epipremnum Pinnatum	Araceae	Tree
86.	Asthma Weed	<i>Euphorbia Hirta L.</i>	Euphorbiaceae	Herb
87.	Indian Tree Spurge	<i>Euphorbia Tirucalli</i>	Euphorbiaceae	Tree
88.	Weeping Fig	<i>Ficus Benjamina</i>	Moraceae	Tree
89.	Curtain Fig	<i>Ficus Microcarpa</i>	Moraceae	Tree
90.	Creeping Fig	Ficus Pumila L.	Moraceae	Climber
91.	Bodhi Tree	<i>Ficus Religiosa</i>	Moraceae	Tree
92.	Silky Oak	<i>Grevillea Robusta</i>	Proteaceae	Tree
93.	Firebush	<i>Hamelia Patens</i>	Rubiaceae	Shrub
94.	Jerusalem Artichoke	<i>Helianthus Tuberosus</i>	Astraceae	Herb
95.	Redivy	<i>Hemigraphis Alternata</i>	Acanthaceae	Herb
96.	Black Spear Grass	<i>Heteropogon Contortus</i>	Poaceae	Herbs
97.	Hibiscus	<i>Hibiscus Rosa-Sinensis</i>	Malvaceae	Shrub
98.	Hibiscus	<i>Hibiscus Syriacus L.</i>	Malvaceae	Shrub
99.	Water Morning Glory	<i>Ipomoea Aquatica</i>	Convolvulaceae	Herb

100.	Coast Morning Glory	<i>Ipomoea Cairica</i>	Convolvulaceae	Climber
101.	Saramollagrass	<i>Ischaemum Dispar</i>	Poaceae	Herb
102.	Indian Murainagrass.	<i>Ischaemum Indium</i>	Poaceae	Herb
103.	Scarlet Jungle Flame	<i>Ixora Coccinea</i>	Rubiaceae	Tree
104.	Common Jasmine	<i>Jasminum Officinale</i>	Oleaceae	Climbers
105.	Peregrina	<i>Jatropha Integerrima</i>	Euphorbiaceae	Shrub
106.	Waukegan Juniper	<i>Juniperus Horizontalis</i>	Cupressaceae	Shrub
107.	Sausage Tree	<i>Kigelia Pinnata</i>	Bignoniaceae	Tree
108.	Common Lantana	<i>Lantana Camara</i>	Verbenaceae	Shrub
109.	Mango Tree	<i>Mangifera Indica L.</i>	Anacardiaceae	Tree
110.	Bullet Wood	<i>Manilkara Elengi</i>	Sapotaceae	Tree
111.	Sapota	<i>Manilkara Zapota</i>	Sapotaceae	Tree
112.	Chinaberry Tree	<i>Melia Azedarach</i>	Meliaceae	Tree
113.	Spearmint	<i>Mentha Spicata</i>	Lamiaceae	Herb
114.	Dog Mercury	<i>Mercurialis Perennis</i>	Euphorbiaceae	Herb
115.	Champak	<i>Michelia Champaca</i>	Magnoliaceae	Tree
116.	Spanish Cherry	<i>Mimusops Elunji</i>	Sapotaceae	Tree
117.	Four -O'clock	<i>Mirabilis Jalapa</i>	Nyctaginaceae	Tree
118.	Indian Mulberry	<i>Morinda Citrifolia</i>	Rubiaceae	Tree
119.	Indian Mulberry	<i>Morinda Tinctoria</i>	Rubiaceae	Tree
120.	Mulberry	<i>Morus Alba</i>	Moraceae	Tree
121.	Jamaican Cherry	<i>Muntingia Calabura</i>	Muntingiaceae	Shrub
122.	Curry Leaf Tree	<i>Murraya Koenigii</i>	Rutaceae	Tree
123.	Banana	<i>Musa Cultivars L.</i>	Musaceae	Tree
124.	Asian Bayberry	<i>Nageia Nagi</i>	Podocarpaceae	Tree
125.	Arali	<i>Nerium Indicum Mill.</i>	Apocyanaceae	Shrub
126.	Fragrant Water Lily	<i>Nymphaea Odorata</i>	Nymphaeaceae	Herbs
127.	American Basil	<i>Ocimum Americanum</i>	Lamiaceae	Herb
128.	Common Basil	<i>Ocimum Basilicum</i>	Lamiaceae	Herb
129.	African Basil	<i>Ocimum Canum</i>	Lamiaceae	Herb
130.	Holy Basil	<i>Ocimum Tenuiflorum</i>	Lamiaceae	Shrub
131.	Jerusalem Thorn	<i>Parkinsonia Aculeata</i>	Fabaceae	Shrub
132.	Famine Weed.	<i>Parthenium Hysterophorus</i>	Asteraceae	Shrub
133.	Stinking Passion Flower	<i>Passiflora Foetida</i>	Passifloraceae	Herb
134.	Passion Flower Vine	<i>Passiflora Incarnata</i>	Passifloraceae	Climber
135.	Veliparuthi	<i>Pergularia Daemia</i>	Acanthaceae	Herb
136.	Pineapple Palm	Phoenix Canariensis	Arecaceae	Tree
137.	Pagoda-Tree	<i>Plumeria Alba</i>	Apocynaceae	Tree
138.	Asoka Tree	<i>Polyalthia Longifolia</i>	Annonaceae	Tree



139.	Dinnerplate-Aralia	Polyscias Scutellaria	Araliaceae	Tree
140.	Dinnerplate-Aralia	<i>Polyscias Scutellaria</i>	Araliaceae	Tree
141.	Pungai	<i>Pongamia Pinnata</i>	Fabaceae	Tree
142.	Moss Rose	<i>Portulaca Grandiflora</i>	Portulacaceae	Herb
143.	Almond	<i>Prunus Amygdalus</i>	Rosaceae	Tree
144.	Common Guava	<i>Psidium Guajava</i>	Myrtaceae	Tree
145.	Chinese Brake	<i>Pteris Vittata L.</i>	Pteridaceae	Shrub
146.	Pomegranate	<i>Punica Granatum</i>	Lythraceae	Shrub
147.	Umbrella Tree	<i>Schefflera Actinophylla</i>	Araliaceae	Shrub
148.	Tanner's Cassia	<i>Senna Auriculata</i>	Fabaceae	Shrub
149.	Black Nightshade	<i>Solanum Nigrum</i>	Solanaceae	Shrub
150.	Peace Lily	<i>Spathiphyllum Wallisii</i>	Araceae	Herb
151.	Sporobolus	<i>Sporobolous Maderaspatans</i>	Poaceae	Herb
152.	Smut Grass	<i>Sporobolus Indicus</i>	Poaceae	Herb
153.	Toothbrush Tree	<i>Streblus Asper</i>	Moraceae	Tree
154.	Black Face General	<i>Strobilanthes Crispa</i>	Acanthaceae	Shrubs
155.	Black Plum	<i>Syzygium Cumini</i>	Myrtaceae	Tree
156.	Teak	<i>Tectona Grandis</i>	Lamiaceae	Tree
157.	Almond Tree	<i>Terminalia Catappa L.</i>	Combretaceae	Tree
158.	Kangaroo Grass	<i>Themeda Trianda</i>	Poaceae	Herb
159.	Indian Jujube	<i>Zizyphus Mauritiana</i>	Rhamnaceae	Shrub
160.	Korean Grass	<i>Zoysia Tenuifolia</i>	Poaceae	Herbs



**Plate.1. Plants found in the Campus**



*Roystonea regia*



*Acacia mangium Willd*



*Terminalia mantaly H.Perrier*



*Codiaeum variegatum*



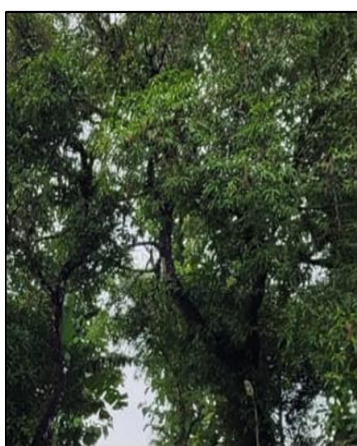
*Psidium guajava*



*Ocimum tenuiflorum L*



*Mangifera indica L*



*Azadiracta indiaca*



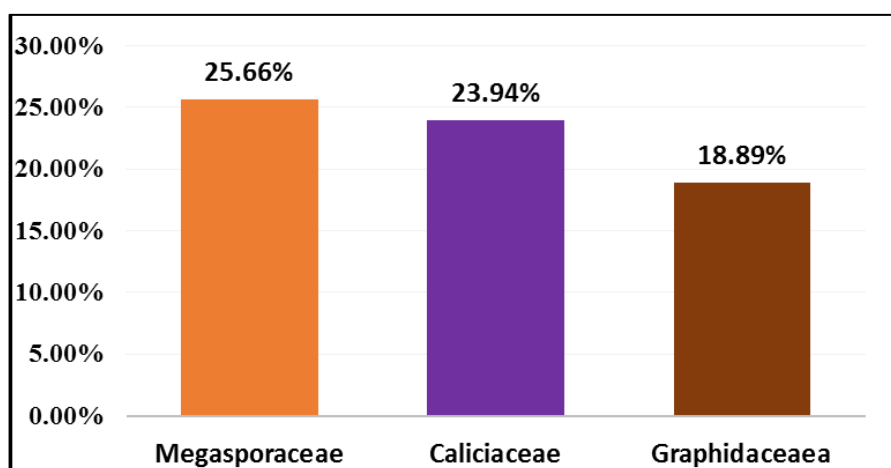
*Musa acuminata Colla*



### 13.3.1.2. Lichen diversity in the campus

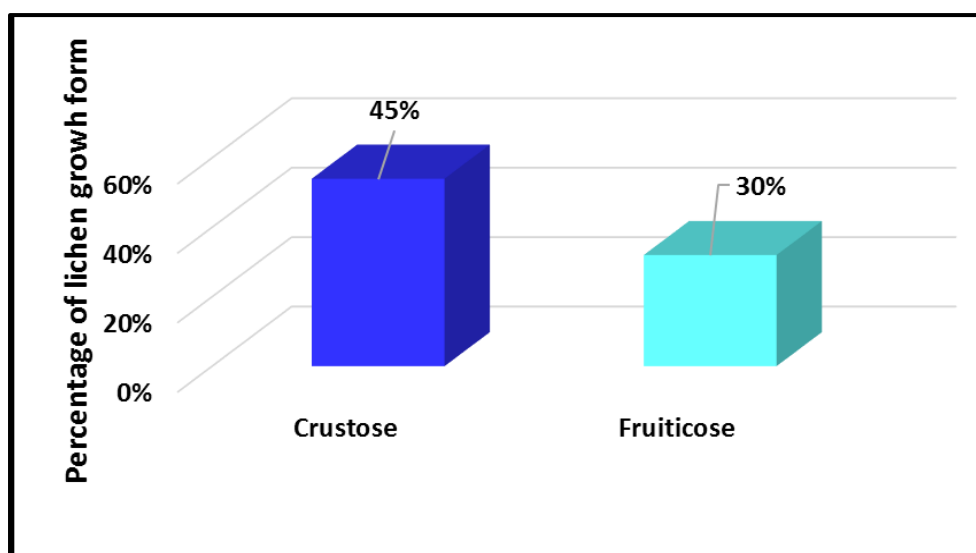
Lichens are one of the most fascinating symbiotic organisms found worldwide. The lichens species are ubiquitous and common inhabitants of the bark of the tree, rock surface, soil etc. They are a lower group of plants coming under non-flowering plants that live in a variety of substrates under a wide range of environmental conditions with or without causing harm to the hosts. Ecologically, lichen plays important roles in soil formation; re-establishes life on earth; fixes atmospheric nitrogen; plant's health, ecology distribution, and in the formation of organic matter of habitat which in turn benefitting mosses in nutrient availability. A unique synergetic association between a fungal and an algal species result 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.

**Fig.4. Lichen Diversity of the Campus**



Lichen diversity recorded in the Nirmala College of Pharmacy campus showed a total of 5 different lichen species representing 2 genera and 2 families (fig.7). Three species accounted for 5% of total available lichens in the campus. 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 2 types of foliose lichens belonging to the genus, *Dimeralla*, *Graphis* were accounted. About 2% lichens were found to be one single species in each genus of crustose and fruticose lichens (fig.5).

**Fig.5. Lichen growth diversity in the campus**



**Table 7. Lichen diversity of the Nirmala College of Pharmacy campus with respect to family, substratum and growth forms in genus and family wise classification**

S.No	Lichen diversity of the campus	Family	Growth forms
1.	<i>Aspicilia cuprea</i> Owe-Larss. & A.Nordin	Megasporaceae	Crustose
2.	<i>Buellia pullata</i> Tuck	Caliciaceae	Crustose
3.	<i>Graphis glauconigra</i> Vainio	Graphidaceae	Fruiticose
4.	<i>Usnea corallina</i> Mot	Parmeliaceae	Fruiticose

### 13.3.3. Algal diversity in the campus

*Oscillatoria*, *Spirogyra*, *Scytonema* and *Cladophora* spp. belonging to the class of Cyanophyceae, Chlorophyceae and Bacillariophyceae are the predominant species found in the campus. The family Chlorellaceae was 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 campus ecosystem has high amount of organic nutrients in soil and rock along with conducive favourable environmental conditions.

#### 13.3.1.3. Mushrooms diversity in the 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 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*).

### 13.3.2. Fauna Diversity in the campus

#### 13.3.2.1. Birds Diversity in the campus

The observations on fauna diversity indicated that the campus has a large number of living as well as visiting birds. A total number of 30 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 11 species of birds representing 2 families and 2 orders were observed during this study, passeriformes constituted the predominated group representing 15. Total number of 6 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, Black-rumped flameback and Peacock (Tables 8 & 9).

**Table 8. Birds Diversity in the campus**

S.no	Scientific name	Common name
1.	<i>Accipiter</i>	shikra
2.	<i>Acridotheres tristis</i>	common myna
3.	<i>Anthusrufulus</i>	black kite
4.	<i>Athenebrama</i>	spotted owlet
5.	<i>Bubulcus ibis</i>	Cattle egret
6.	<i>Coraciasbenghanlensis</i>	Indian roller
7.	<i>Corvus splendens</i>	House crow
8.	<i>Dicruridaemacrocerus</i>	black drongo
9.	<i>Egretta garzetta</i>	Little egret
10.	<i>Eudynamysscolopaceus</i>	Asian koel
11.	<i>Haliasturindus</i>	brahminy kite-
12.	<i>Leptocoma zeylonica</i>	Purple-rumped sunbird
13.	<i>Megalaima zeylanic</i>	Brown-headed barbet
14.	<i>Merops orientalis</i>	Green bee-eater
15.	<i>Motacilla</i>	Indian robin
16.	<i>Passeridae</i>	Sparrow
17.	<i>Pavo cristatus</i>	Peacock
18.	<i>Columbidae</i>	Dove



**Table 9. Total number of visiting birds in the campus**

S.No	Common Name	Scientific Name
1.	Koel	<i>Eudynamys scolopaceus</i>
2.	Rose-ringed	<i>Psittacula krameri</i>
3.	Mangrove heron	<i>Butorides striata</i>
4.	Wood shrike	<i>Tephrodornis Pondicerianus</i>

**13.3.2.2. Butterflies diversity in the campus**

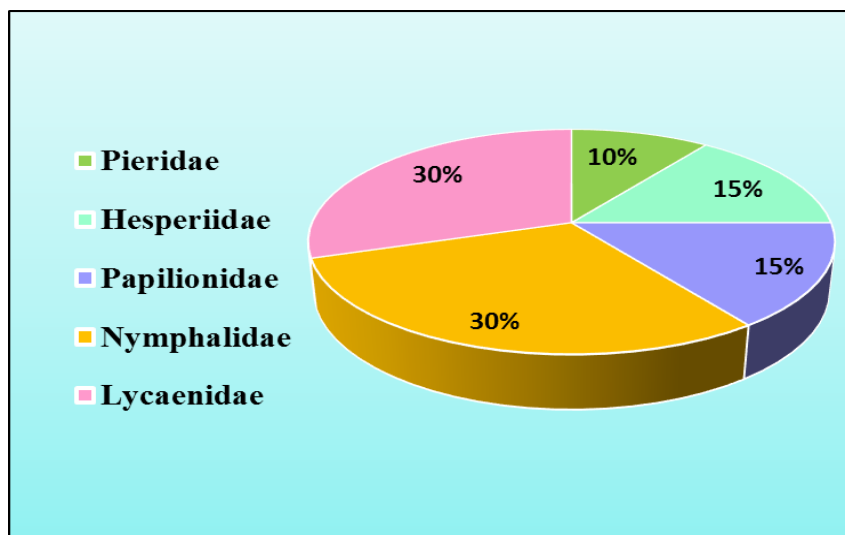
The campus has five family level diversities such as Papilionidae, Pieridae, Nymphalidae, Lycaenidae and Hesperidae in which Common butterflies species such as Mormon, Rose, Birdwing, Emigrant, Grass yellow, Gull Wanderer, Small Orange Tip, Plain Orange Tip, White Orange Tip, Yellow Orange Tip, Pioneer Chocolate, Pansy, Baron, Palmfly, Bush, Brown, Eggfly, Leopard, Sailer, Evening and Grey are commonly found (Table 10; Plate 4).

**Table 10. List of Butterflies recorded in the 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.	Tamil yeoman	<i>Cirrochroa thais</i>	Nymphalidae
6.	Rustic	<i>Cupha erymanthis</i>	Nymphalidae
7.	Plain tiger	<i>Danaus chrysippus</i>	Lycaenidae
8.	Tiger	<i>Danaus genutia</i>	Nymphalidae
9.	Common crow butterfly	<i>Euploea core</i>	Papilionidae
10.	African Marbled Skipper	<i>Gomalia elma</i>	Hesperidae
11.	Tailed jay	<i>Graphium agamemnon</i>	Papilionidae
12.	Common banded	<i>Hasora chromus</i>	Hesperidae
13.	Yellow Orange Tip	<i>Ixias pyrene</i>	Pieridae
14.	Lime Butterfly	<i>Papilio demoleus</i>	Papilionidae
15.	Red Pierrot	<i>Talicauda nyseus</i>	Lycaenidae
16.	Common Grass Dart	<i>Taractrocera maevius</i>	Hesperidae
17.	Blue tiger	<i>Tirumala limniace</i>	Nymphalidae
18.	Dark blue tiger	<i>Tirumala septentrionis</i>	Nymphalidae
19.	White hedgege	<i>Udara akasa</i>	Lycaenidae
20.	Painted lady	<i>Vanessa cardui</i>	Nymphalidae



#### Plate 4. Butterfly Diversity in the campus



#### 13.3.2.3. Mammals diversity in the 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 Nirmala College of Pharmacy campus indicated that around 5 Mammal species are commonly distributed. The commonly found mammals are Black-naped Hare, Three-striped Palm Squirrel, Common or Grey Mongoose, Indian Flying Fox, Short-nosed Fruit Bat, House Rat and Indian Mole-rat. (Table.11)

**Table11. List of Mammals diversity in the campus**

S.No.	Common Name	Scientific Name	Common Name
1.	Black-naped Hare	<i>Lepus nigricollis</i>	Muyal
2.	Three-striped Palm Squirrel	<i>Funambulus palmarum</i>	Anil
3.	Indian Flying Fox	<i>Pteropus giganteus</i>	Periya Vowaal
4.	House Rat	<i>Rattus rattus</i>	Sundeli
5.	Indian Mole-rat	<i>Bandicota bengalensis</i>	Peruchali

#### 13.3.2.4. Amphibians diversity in the 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 Campus indicated that around 6 species are 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 60% are frogs. Observation made in the Campus on diversity of Amphibians revealed that around 3 species of Amphibians are commonly disseminated.

### 13.3.2.5. Grasshopper diversity in the 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 the campus on diversity of Grasshoppers demonstrated that 4 species are Amphibians are commonly distributed which includes *Eyprepocnemis alacris*, *Cyrtacanthacris tartarica*, *Crucinotacris decisa* and *Aulacobothrus luteipes*.

### 13.3.2.6. Termites Diversity in the 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 Nirmala College of Pharmacy 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 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 CO<sub>2</sub> 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 Nirmala College of Pharmacy campus revealed that the capus is well distributed with more oxygen releasing and CO<sub>2</sub> 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*, *Epipremnum aureum* and *Medicinal garden* is also available in the campus (Table. 11).

#### Indoor Plants found in the Campus



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

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



### 13.4.1. Measurement of Carbon dioxide level in the Campus

Climatic conditions of the earth changed now-a-days due to a massive increase in global warming and environmental changes including human population and human activities. In addition, primarily fossil fuel burning and an extensive usage enhances heat-trapping greenhouse gas levels in the atmosphere. Global warming is driven by human-induced emissions of greenhouse gases which resulted in paramount shifts in weather patterns. It is playing an important role to act as a global indicator for checking the purity of the atmosphere. In general, a portable CO<sub>2</sub> Analyzer is used to measure the level of carbon dioxide in the atmosphere at different places across the campus.

The observation showed that the concentration of CO<sub>2</sub> in the atmosphere is found to be optimal which did not exceed the critical limit of CO<sub>2</sub>. It is further revealed that all the selected locations are having pure air without any air contaminants with good air exchange/circulation in the campus. Some of the places like Canteen, Class Rooms, and Examination Centre are recorded with high level of carbon dioxide level due to student mobilization and the maximum number of electrical items fixed from which the carbon dioxide emission and poor ventilation were observed followed by all laboratories and seminar and auditorium halls (Table 12).

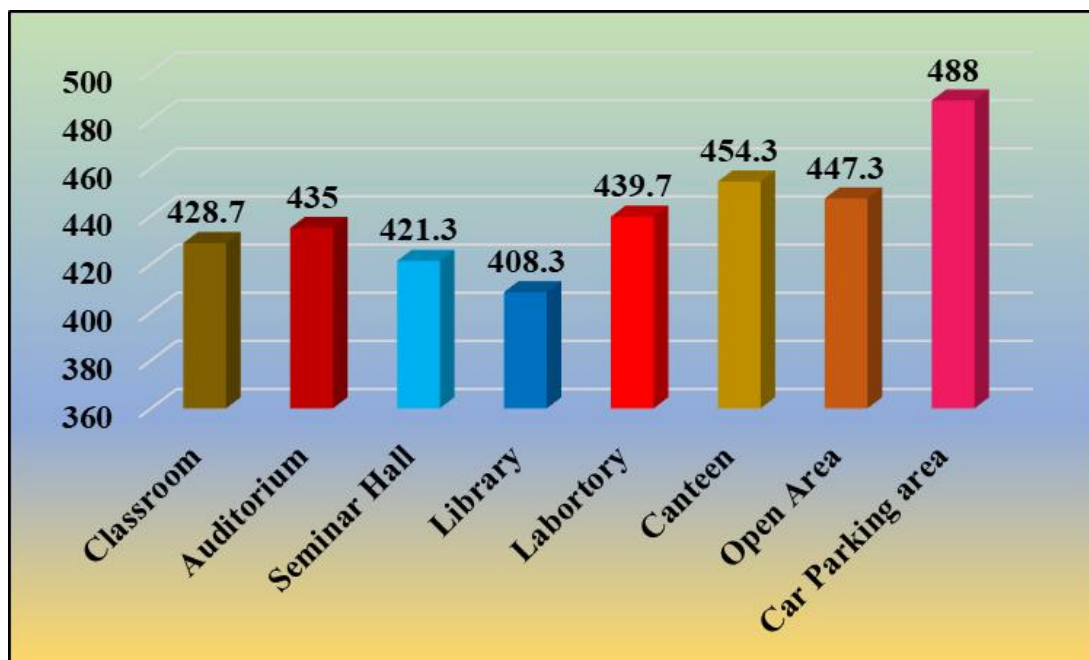
**Table. 12. Measurement of CO<sub>2</sub> concentration in the College Campus**

S.No.	Different locations of the Organization's Campus	Carbon dioxide level (ppm)*	Remarks
1.	Classroom	428.7±3.0	Within permissible limits
2.	Auditorium	435.0±4.0	Within permissible limits
3.	Seminar Hall	421.3±2.5	Within permissible limits
4.	Library	408.3±2.5	Within permissible limits
5.	Labortory	439.7±8.0	Within permissible limits
6.	Canteen	454.3±5.7	Within permissible limits
7.	Open Area	447.3±13.4	Within permissible limits
8.	Car Parking area	488.0±4.6	Within permissible limits
	Mean		443.6 %
	SEC ±		5.89
	CD at P=0.05%		10.5

**\*Average of 3 Observations**



**Plate 5. Measurement of CO<sub>2</sub> concentration in the College Campus**



#### Reference of Set values of CO<sub>2</sub> level

As per (ASHARE 62-2019) Indoor air Quality parameters Threshold values

- Class A (Aspirational) = Ambient is 350
- Class B (Within permissible limits) = Ambient is 500
- Class C (Marginally Acceptable) = Ambient is 700

#### 13.4.2. Atmospheric Oxygen level measurements analysis and interpretation

Oxygen level refers to the amount of oxygen available within the atmosphere or water bodies. Oxygen is produced/released as a by-product of photosynthesis, the metabolic activity of all green plants besides certain microbes. Oxygen plays a paramount role in metabolic activities like respiration and the energy-producing chemistry of all living organisms. In order to quantify the oxygen level, Oxygen Meter is used. The atmosphere contains 18-21% oxygen concentration, 75-78.5% nitrogen and 2-3% other gases like carbon dioxide, neon, and hydrogen. The amount of oxygen level in the atmosphere is determined by abiotic factors like altitude, latitude and longitude and biotic factors like plantations in the surroundings. If oxygen level is low in the atmosphere lead to headaches and shortness of breath to human beings. If it excess, it causes oxygen toxicity and oxygen poisoning by creating coughing, breathing trouble and damage the lungs to human beings. The Oxygen level of different places at the campus are monitored and presented (Table 13 & Plate 6)).

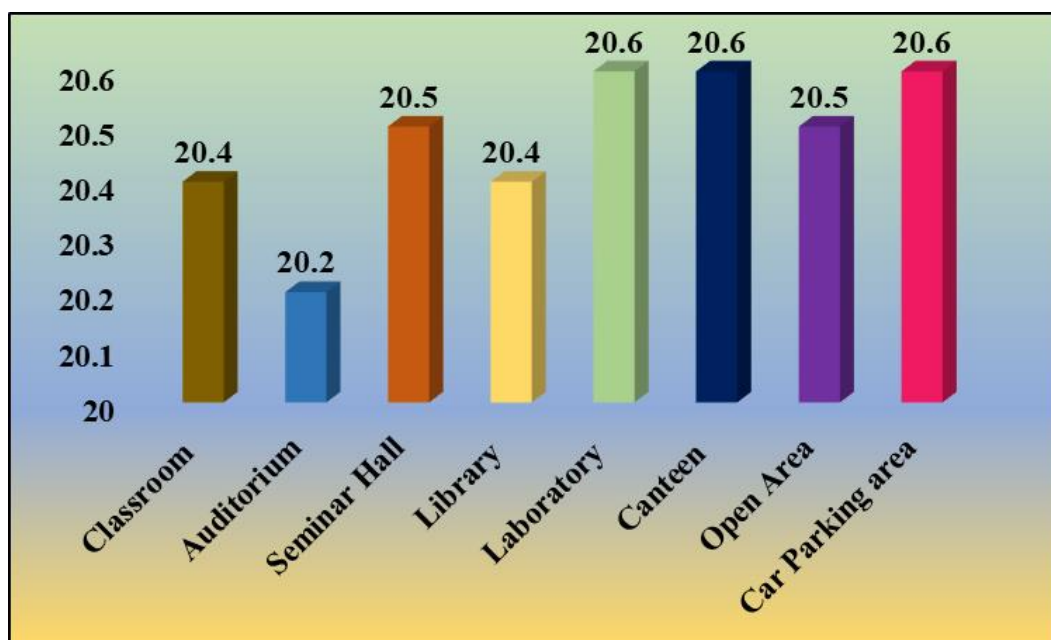




**Table 13. The Oxygen concentration in the Nirmala College of Pharmacy**

S. No	Location	Oxygen Level (%)*	Remarks
1.	Classroom	20.4±0.2	O <sub>2</sub> level is good
2.	Auditorium	20.2±0.1	O <sub>2</sub> level is good
3.	Seminar Hall	20.5±0.2	O <sub>2</sub> level is good
4.	Library	20.4±0.3	O <sub>2</sub> level is good
5.	Laboratory	20.6±0.2	O <sub>2</sub> level is good
6.	Canteen	20.6±0.3	O <sub>2</sub> level is good
7.	Open Area	20.5±0.2	O <sub>2</sub> level is good
8.	Car Parking area	20.6±0.2	O <sub>2</sub> level is good
	Mean		20.48 %
	SEC ±		0.19
	CD at P=0.05%		0.34

\*Average of 3 Observations

**Plate 6. The Oxygen concentration in the College Campus**

### 13.5. Lawns, Trees, Herbs, Shrubs, Climbers and Lianas in the 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 CO<sub>2</sub> 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 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 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 campus. The predominant species of herbs available in the Insitution are *Tradescantia spathaceae* (Croton) and *Vinca rosea* (Bright eyes).

The existence of climber, creepers, twiners and lianas species available which accounted more than seven species in the campus is Amirtaval (*Tinospora cordifolia*). The major grasses are Arugam Pullu (*Cynodon dactylon*), Korai Pullu (*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 climbs up trees and walls and grow vigorously without any pest and disease attach which are observed in the campus.



### 13.6. Establishment of different Gardens in the 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 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 the campus, 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 many varieties of ornamentals plants are maintaining surrounding of the college campus. In front of principal's room, cafeteria, college grounds and many places planted ornamentals plants. Nearly 100 plants in different places. These plants are making the college campus pleasantly and decoratively. 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 pleasant and lively.



### 13.7. Natural Topography and Vegetation

Natural topography means the original geographical features of the campus, around 60-65% 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 70% 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 campus indicated that more than 35% natural topography and vegetation have been maintained properly. Further, there was no anthropogenic activity in 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 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 Nirmala College of Pharmacy 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 Nirmala College of Pharmacy 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 Nirmala College of Pharmacy campus is free of exotic plants that cause threat to the natural vegetation. It is like 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 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 Nirmala College of Pharmacy 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 Nirmala College of Pharmacy 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 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 campus 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 Muvattupuzha. The Nirmala College of Pharmacy 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 Nirmala College of Pharmacy 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.

The College is implemented the Government schemes (Swachh Bharath Abhiyan under Clean India Mission) to give pure and safe water to rural people and teach the importance of cleanliness of toilets and restrooms to people living in Muvattupuzha city. These activities are very important in view of the instantaneous vicinity to undertake progressive programmes and conducted Participatory rural appraisal programmes. It is involving the socioeconomic position of the inhabitants, natural resources, traditional knowledge systems, cropping patterns, etc. of the rural and tribal people. The Nirmala College of Pharmacy is also focusing on the development of women, youth, children and dalits and to identify the extension and training needs of



the target group. It provides the vocational training to marginal farmers to overcome the problem of seasonal employment. Some of areas identified are goat farming, mushroom cultivation, vermicomposting, bee keeping, ornamental fisheries, organic farming and medicinal plant cultivation.

The College helps to develop social commitment and to expose the students to get sensitized to social realities and to build a link between the student community and the wider community. It enhances the social interaction, inter-personal communication skills and develop emotional maturity of students. It also helps students in total and integrated personality development. The College facilitates to prepare the students for future life, by developing qualities such as cooperation, teamspirit, leadership, discipline and development of creative talents including to boost the self-confidence of students.

### **13.15. Establishment of Aquarium and Aquatic plant**

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 Nirmala College of Pharmacy campus has initiated to start a good aquatic site in which aquatic plants, Fishes 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 Nirmala College of Pharmacy 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 Nirmala College of Pharmacy is maintaining more than 75% 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 30% and planted vegetation was 65%.

2. The Nirmala College of Pharmacy campus is belonging to Muvattupuzha 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 Nirmala College of Pharmacy has created 'Medicinal Garden' for establishing a massive reforestation / afforestation planting programme in which a large number of trees and shrubs species were planted together with a minimum distance covering fruits, nuts and timber yielding plants are planted.
4. In view of floral biodiversity in the Nirmala College of Pharmacy Campus, a sum 160 species belonging to 90 Genera under 60 families covering trees, herbs, shrubs, climbers, lianas, twiners and lawns and 12 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 Nirmala College of Pharmacy Campus, a total of 5 living Mammals representing two Genera under two families, visiting Mammal species (5), 25 species of birds, 3 species of Grasshopper, 2 species of Termites, 3 species of Amphibians, 3 species of Reptiles, 33 species of Butterflies and Three species Mosquitos were recorded and documented.
6. The Nirmala College of Pharmacy 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 Tulsi, *Areca* Palm, Banyan tree, Money plant, Neem tree, *Arjun* tree and *Pongam* trees including some of the shrub and herbal plants.
8. Gardens inside the college premises are found well maintained.
9. Nature Conservation is well maintained.

## 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.
- Nirmala College of Pharmacy 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.
- Use of fossil fuels has to be reduced for the sake of community health.
- 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.

## 16. Conclusion

After the establishment of Nirmala College of Pharmacy, Muvattupuzha, 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 Nirmala College of Pharmacy is a well-established Private Institution in Muvattupuzha 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 Nirmala College of Pharmacy campusis maintaining more than 75% of the green cover area after building construction along with 30% of natural vegetation and 65% planted vegetation.

The natural topography and very good landscape design without disturbing the natural vegetation are being maintained by the Nirmala College of Pharmacy. 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 Nirmala College of Pharmacy, Muvattupuzha, 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 Nirmala College of Pharmacy Management will create Clean and Green Environment and this will be taken care of by up coming generation and propagate further.



## Annexure - I

### 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 .....	Mangnoliaceae
b. Herbs, petals coloured unlike the sepals; carpels united.....	12
12a. Plants with yellow sap, Flowers pedicelled .....	Papaveraceae
B. Plants with watery sap, Flowers sessile.....	Portulacaceae
13a. Flowers unisexual, gynoecium apocarpus.....	Menispermaceae
b. Flowers bisexual, gynoecium Syncarpous.....	14
14a. Petals 4, Stamens 6 .....	Brassicaceae
b. Petals 5, Stamens $\infty$ .....	15
15a. Ovary 1, loculated .....	16
b. Ovary 2-more loculated.....	17
16a. Flowers actinomorphic, placentas free- central .....	Caryophyllaceae
b. Flowers zygomorphic, placentas parietal .....	Viloeaceae
17a. Filaments of anthers more or less united .....	Polygalaceae
b. Filaments of anthers more or less united .....	18
18a. Leaves stipulate; stamens 5 or 10 .....	19
b. Leaves exstipulate; stamens usually 8 .....	Sapindaceae
19a. Style 5; stamen 5 .....	Oxalidaceae



- b. Style many; stamens 10 ..... Zygophyllaceae
- 20a. Leaves pellucid-gland dotted ..... Rutaceae
- b. Leaves not gland dotted .....21
- 21a. Placentas parietal; Fruit elongated .....Moringaceae
- b. Placentas axile; Fruits not elongated .....22
- 22a. Ovules and seeds pendulous; sometimes horizontal.....Meliaceae
- b. Ovules and seeds erect or ascending .....23
- 23a. Stamens alternate with the petals..... Anacardiaceae
- b. Stamens opposite the petals .....Vitaceae
- 24a. Leaves simple; Flowers 3-merous.....Annonaceae
- b. Leaves compound; Flowers 4-6 merous ..... 25
- 25a. Filaments of anther united into a columnar toothed cup.....26
- b. Filaments of anther free; rarely connate at the base in ring .....28
- 26a. Stamens 15; anther united .....Stericuliaceae
- 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 .....Caesalpinaceae
- 37a. Flowers unisexual.....Cucurbitaceae
- b. Flowers bisexual.....38
- 38a. Ovary 1-celled.....Cactaceae
- b. Ovary more than 1 celled.....39
- 39a. Carpels free if ultimately united the styles distinct.....40
- b. Carpels and styles united throughout.....Myrtaceae
- 40a. Flowers in dichasial – polychasial cyme.....Molluginaceae
- b. Flowers in clustered, cymes or solitary.....Aizoaceae
- 41a. Ovary inferior, stamens as many as the corolla lobes.....42
- b. Ovary superior, stamens numerous.....43
- 42a. Anther free; ovary 2-loculed; stipulate.....Rubiaceae
- b. Anther syngenesious; ovary 1-loculed, exstipulate.....Asteraceae

- 43a. Ovary 1-loculed; placentation free central.....Plumbaginaceae  
 b. Ovary 2-many loculed; placentation axile or parietal.....44
- 44a. Ovary 3 or more carpelled.....Sapotaceae  
 b. Ovary 2-carpelled.....45
- 45a. Corolla actinomorphic.....46  
 b. Corolla zygomorphic.....50
- 46a. Plants leafless; parasitic.....Cuscutaceae  
 b. Plants leafy ; not parasitic .....47
- 47a. Leaves opposite; stamens 2.....--48  
 b. Leaves alternate; stamens 4 or more .....49
- 48a. Leaves not scabrid, corolla tube white: fruits berry .....Oleaceae  
 b. Leaves scabrid; corolla tube orange; fruits capsules .....Nyctanthaceae
- 49.a. Anther inseperatable; corona present .....Asclepidiaceae  
 b. Anther seperatable; corona absent .....Apocyanaceae
- 50a. Corolla lobes imbricate ;fruit drupe .....Boraginaceae  
 b. Corolla lobes plicate; fruit capsule .....Convolvulaceae
- 51.a Ovary cells many ovulated .....Solanaceae  
 b. Ovary cells 1-4 ovuled.....52
- 52.a Carpels 2 or more ovulated ; fruits dehiscent .....53  
 b. Carpels 1 –ovulated ; fruits indehiscent .....57
- 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 winged .....Bignoniaceae  
 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 placentation .....Pedaliaceae  
 b. Flowers raceme; axile placentation.....Martyiniaceae
- 57.a Ovary entire, style terminal .....Verbinaceae  
 b. Ovary 4 –lobed, style gynobasic.....Lamiaceae
- 58.a Flower bisexual .....59  
 b. Flower unisexual .....62
- 59.a. Ovary inferior .....60  
 b. Ovary superior .....61
- 60.a Ovary 4-6 loculated; ovules many .....Aristolochiaceae  
 b. Ovary 1-loculated; ovules 1-4 .....Santalaceae
- 61.a Perianth not tubular .....Amarathaceae  
 b. Perianth trubular .....Nyctaginaceae
- 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 .....*Leptogium cyanascens*.
- 1 b. Photobiont green alga .....2
2. Thallus leprose, crustose.....Group I
3. Thallus foliose.....Group II
4. Thallus fruticose.....Group III

#### Group I

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

#### Group II

- 1 a. Lower side of thallus pseudocyphellae, photobiont Nostoc .....*Pseudocyphellaria*
- 1 b. Thallus lacking pseudocyphellae .....2
- 2 a. Upper cortex thick walled longitudinally oriented, conglutinate hyphae.....3
- 2 b. Upper cortex otheriwse.....4
- 3 a. Thallus lower side canaliculated zeorin, norstictic and salazinic acids, and unknown pigments and triterpenoids present.....*Heterodermia leucomelos*
- 3 b. Thallus lower side no canaliculated only in medulla.....*Heterodermia diademata*
- 4 a. Cilia bulbate at the base, thallus grey to grey brown .....*Bulbothrix*
- 4 b. Cilia present or absent, not bulbate.....5
- 5 a. Rhizines dichotomously branched present throughout the margins....*Hypotrachyna*
- 5 b. Rhizines restricted to center of lower surface, margin bare, smooth shining.....6
- 6 a. Lobes narrow, long, dichotomously branched, canaliculate.....*Everniastrum*
- 6 b. Lobes otherwise.....7
- 7 a. Lobe margins ciliate.....8



7 b. Lobe margins eciliate.....	9
8 a. Salazinic acid present K+ Red cortex.....	10
8 b. Salazinic acid 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
IB. Plant pigments not contained, but diffused through protoplast -----	2
2A. Plants filamentous; cells arranged in trichomes -----	4
2B. Plants colonial, not filamentous -----	3
3A. Cells in regular rows, in multiples of four; -----	<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 -----*Chodatella*  
 55B Cells with multiple peripheral long delicate setae -----*Golenkinia*  
 56A Cells long, slender, and tapered at both ends -----*Ankistrodesmus*  
 56B Cells flattened or isodiametric, triangular, quadrangular -----*Tetraedron*

#### 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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مركز الإمارات العالمي للاعتماد  
 Emirates International Accreditation Centre  
 035-CB-QMS




ENVIRONMENTAL MANAGEMENT SYSTEM

# Certificate of Registration



*This is to Certify That The Environmental Management System of*



**NATURE SCIENCE FOUNDATION**  
LIG II, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004,  
TAMILNADU, INDIA.


*has been assessed and found to conform to the requirements of*



## ISO 14001:2015

*for the following scope :*

PROVIDING CONSULTANCY SERVICES FOR ENVIRONMENT, ENERGY, GREEN, HYGIENE, SOIL AND WATER, WASTE MANAGEMENT, BIOMEDICAL WASTE MANAGEMENT, E-WASTE MANAGEMENT, PLASTIC WASTE MANAGEMENT AND ACADEMIC AND ADMINISTRATIVE AUDITS TO EDUCATIONAL INSTITUTIONS AND INDUSTRIAL SECTORS AS PER THE OWN CHECKLISTS, START UP THE INTERNATIONAL ECO CLUB STUDENTS CHAPTER, OFFERING LEAD AUDITOR COURSE ON ENERGY AND ENVIRONMENT, AWARDS TO MERITORIOUS CANDIDATES.

<b>Certificate No</b>	22DEJI67	
Initial Registration Date	: 21/05/2022	Issuance Date : 21/05/2022
Date of Expiry*	: 20/05/2025	
1st Surve. Due	: 21/04/2023	2nd Surve. Due : 21/04/2024

  
**DIRECTOR**  
**ROHS Certification Pvt. Ltd.**  
B-7, 1st Floor, Sector-2 Noida, Gautam Budh Nagar, UP-201301  
 e-mail : info@rohs-certification.co.in | website : www.rohs-certification.co.in  
 The Registration is not a Product Quality Certificate. \*Subject to successful completion of surveillance audits. Visit for verification on www.rohs-certification.co.in  
 Certificate is the property of ROHS and return when demanded.





**QCS** MANAGEMENT PVT. LTD.

MANAGEMENT SYSTEMS CERTIFICATION

## *Certificate of Registration*

**ISO 45001:2018 (Occupational Health & Safety Management System)**

### **NATURE SCIENCE FOUNDATION**

ADDRESS: NO. 2669, LIG-II, GANDHI MANAGAR PEELAMEDU COIMBATORE - 641 004 TAMIL NADU, INDIA.

#### **Scope of Certification:**

PROVIDING TRAINING AND AUDITING SERVICES IN THE FIELD OF GREEN CAMPUS, ENVIRONMENT, ENERGY, OCCUPATIONAL HEALTH AND SAFETY, HYGIENE AND WASTE MANAGEMENT AT EDUCATIONAL INSTITUTES AND INDUSTRIAL SECTOR.

Certificate Number : QCS/EUAS/OHS/002

Issue Date : 03/08/2022  
Expiration Date : 02/08/2023

1<sup>ST</sup> Surveillance Audit Within : 02/07/2023  
2<sup>nd</sup> Surveillance Audit Within : 02/07/2024  
Re-certification Due Date : 02/08/2025



Partha Bagchi  
(Managing Director)

Validity of this Certificate is subject to Surveillance Audits to be conducted before scheduled due dates of surveillance audits as mentioned on the certificate, failing which the certificate will stand to be withdrawn and need to be treated as an initial certification process to reactivate its continuity on the register of EUAS and QCS. This Certificate is valid when confirmed by data listed on the (Euro Universal Accreditation Systems) EUAS" [www.euas-ac.org](http://www.euas-ac.org). The authenticity & validity of this certificate may be re-affirmed by referring to our company website - [www.qcsp.com](http://www.qcsp.com). Lack of fulfillment of conditions as set out on the 'Certification Contract' (Annex 13) may render this certificate invalid. Any alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of law. This certificate remains the property of QCS and to be returned on request.

REGISTERED OFFICE: 37E/1(310) 2<sup>ND</sup> STREET, MODERN PARK, GREENAGE APARTMENT - 2<sup>ND</sup> FLOOR,  
SANTOSH PUR, KOLKATA - 700075, WEST BENGAL, INDIA.

Email: [info@qcsp.com](mailto:info@qcsp.com) Call: +91 8697724963, +91 8902447427. Website: [www.qcsp.com](http://www.qcsp.com)





## *Certificate of Registration*

This is to certify that

### **NATURE SCIENCE FOUNDATION**

**LIG II, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004,  
TAMILNADU, INDIA.**

has been independently assessed by QRO  
and is compliant with the requirement of:

**ISO 50001:2018**

### **Energy Management Systems**

For the following scope of activities:

PROVIDING CONSULTANCY SERVICES FOR ENVIRONMENT, ENERGY, GREEN, HYGIENE, SOIL AND WATER, WASTE MANAGEMENT, BIOMEDICAL WASTE MANAGEMENT, E-WASTE MANAGEMENT, PLASTIC WASTE MANAGEMENT AND ACADEMIC AND ADMINISTRATIVE AUDITS TO EDUCATIONAL INSTITUTIONS AND INDUSTRIAL SECTORS AS PER THE OWN CHECKLISTS, START UP THE INTERNATIONAL ECO CLUB STUDENTS CHAPTER, OFFERING LEAD AUDITOR COURSE ON ENERGY AND ENVIRONMENT, AWARDS TO MERITORIOUS CANDIDATES.

Date of Certification: 9th August 2022

2<sup>nd</sup> Surveillance Audit Due: 8th August 2024

1<sup>st</sup> Surveillance Audit Due: 8th August 2023

Certificate Expiry: 8th August 2025

**Certificate Number: 305022080903EN**



*Chunanku..*  
Head of Certification

Validity of this certificate is subject to annual surveillance audits to be done successfully on or before 365 days from date of the audit. (In case surveillance audit is not allowed to be conducted; this certificate shall be suspended / withdrawn).

The Validity of this certificate can be verified at [www.qrocet.org](http://www.qrocet.org)

This certificate of registration remains the property of QRO Certification LLP, and shall be returned immediately upon request.

India Office : QRO Certification LLP

142, IInd Floor, Avtar Enclave, Near Paschim Vihar West Metro Station, Delhi-110063, (INDIA)

Website : [www.qrocet.org](http://www.qrocet.org), E-mail : [info@qrocet.org](mailto:info@qrocet.org)



UDYAM REGISTRATION NUMBER		UDYAM-TN-03-0073706																					
NAME OF ENTERPRISE		M/S NATURE SCIENCE FOUNDATION																					
TYPE OF ENTERPRISE *		MICRO																					
MAJOR ACTIVITY		SERVICES																					
SOCIAL CATEGORY OF ENTREPRENEUR		GENERAL																					
NAME OF UNIT(S)		<table border="1"> <thead> <tr> <th>S.No.</th> <th>Name of Unit(s)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Green Campus, Energy and Environment Management Audits</td> </tr> </tbody> </table>		S.No.	Name of Unit(s)	1	Green Campus, Energy and Environment Management Audits																
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OFFICIAL ADDRESS OF ENTERPRISE		<table border="1"> <thead> <tr> <th>Flat/Door/Block No.</th> <th>LIG-IL2669</th> <th>Name of Premises/ Building</th> <th>GANDHIMAA NAGAR</th> </tr> </thead> <tbody> <tr> <td>Village/Town</td> <td>Gandhimaanagar S.O</td> <td>Block</td> <td>LIG-II</td> </tr> <tr> <td>Road/Street/Lane</td> <td>Peelamedu</td> <td>City</td> <td>Coimbatore South</td> </tr> <tr> <td>State</td> <td>TAMIL NADU</td> <td>District</td> <td>COIMBATORE , Pin 641004</td> </tr> <tr> <td>Mobile</td> <td>9566777255</td> <td>Email:</td> <td>chairmannsf@gmail.com</td> </tr> </tbody> </table>		Flat/Door/Block No.	LIG-IL2669	Name of Premises/ Building	GANDHIMAA NAGAR	Village/Town	Gandhimaanagar S.O	Block	LIG-II	Road/Street/Lane	Peelamedu	City	Coimbatore South	State	TAMIL NADU	District	COIMBATORE , Pin 641004	Mobile	9566777255	Email:	chairmannsf@gmail.com
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Road/Street/Lane	Peelamedu	City	Coimbatore South																				
State	TAMIL NADU	District	COIMBATORE , Pin 641004																				
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)

Visit : [www.msme.gov.in](http://www.msme.gov.in) ; [www.dcmsme.gov.in](http://www.dcmsme.gov.in) ; [www.champions.gov.in](http://www.champions.gov.in)

Follow us @minmsme & @msmechampions

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The screenshot shows the top section of the NGO DARPAN website. At the top left, there is the Government of India emblem, the 'NGO' logo, and the 'D ARPAN' logo. On the top right, it says 'NITI Aayog, Government of India'. Below this is a dark navigation bar with links: Home, About Us, NGO Directory, Search NGOs, Report, Guidelines, Circulars, Help, Apply Grant, and Blacklisted NGOs. A 'Login/Register' button is on the far right. The main banner features a photo of a group of people and the text 'NGO DARPAN' with a sub-headline: 'In order to strengthen services of the portal, Government has decided to make PAN Number of VO's/NGOs mandatory.' Below the banner, a light blue bar says 'Please Update Your Profile'. A teal bar contains the text 'Welcome, Nature Science Foundation'. A light blue box displays '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.

F.2984



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

URN No. 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. URN No. 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)

Digitally signed by SIBICHEN MATHEW  
DN: cn=SIBICHEN MATHEW, o=Income Tax Department, ou=Income Tax Department, email=sibichen.mathew@income.gov.in, c=IN

Digitally signed by  
SIBICHEN MATHEW  
Date: 2023.04.03  
15:52:36 IST



## Certificates of Green Campus Auditors

1. ISO Environment Management System (14001:2015) of Dr. S. Rajalakshmi, Chairman of NSF.
2. ISO Environment Management System (14001:2015 TUV NORD) of Dr. A. Geethakarhi, 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. Botanist and Subject Expert of Plant Taxonomy of Dr. D. Vinoth kumar, Joint Director of NSF.
6. 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: 17<sup>th</sup> Jun. 2021

Training Date : 20<sup>th</sup> to 24<sup>th</sup> 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](mailto: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

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](http://www.tuev-nord-cert.com)





## Medicinal Plants Farms

1999-2000

Kuppayee Thottam, Vadugampalayam Privu,  
Gobi.

### ATTENDANCE CERTIFICATE FOR INSTITUTIONAL 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

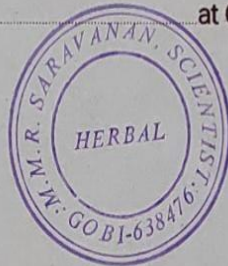
and Collection of medicinal plants for 14 days from 18.12.99 to

31.12.99

at Gobi.

Station : GOBI

Date : 31.12.99



*M. R. Saravanan*

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**

*Dinesh Kumar D*

### 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 **7<sup>th</sup>** day of **February, 2013**

*Rakesh Kumar Rai*

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

Secretary  
Bureau of Energy Efficiency  
New Delhi

Dates of attending the refresher course	Secretary's Signature	Dates of attending the refresher course	Secretary's Signature
<b>22.12.2019</b>	<i>Dinesh Kumar D</i>		





Regn. No. EA-7391  Certificate No. 5093

**National Productivity Council**  
(National Certifying Agency)

**PROVISIONAL CERTIFICATE**

This is to certify that Mr. / Ms. N. Balasubramaniam  
son / daughter of Mr. M. Nanjukuttigounder  
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.


He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.

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.

This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.

Place : Chennai, India  
Date : 11<sup>th</sup> February 2010

  
Controller of Examination

 ENERGY IS LIFE  
CONSERVE IT

**ऊर्जा दक्षता ब्यूरो**  
**BUREAU OF ENERGY EFFICIENCY**  
विद्युत मंत्रालय, भारत सरकार  
MINISTRY OF POWER, GOVERNMENT OF INDIA

प्रमाणित किया जाता है कि


श्री/श्रीमती दिनेश कुमार ने ऊर्जा संरक्षण भवन निर्माण संहिता के लिए 7 दिसंबर '16 से 8 दिसंबर '16 तक एमएनआईटी / सीईपीटी / आईआईआईटी द्वारा आयोजित मास्टर ट्रेनर सर्टिफिकेट कार्यक्रम को सफलता पूर्वक सम्पन्न कर लिया है।

This is to certify that

Shri/Smt. Dinesh Kumar has successfully completed the Master Trainer Certificate Programme conducted by MNIF / GEPT / IIIT from 7 December '16 to 8 December '16 for the Energy Conservation Building Code.

नई दिल्ली, 07 JUL 2017  
New Delhi, \_\_\_\_\_

अशोक वाक  
महानिदेशक  
Director General

	<p>GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT</p> <p><b>DINESH KUMAR D</b></p> <p>HAS ATTAINED THE DESIGNATION OF</p> <p><b>LEED AP<sup>®</sup> Building Design + Construction</b></p> <p>by demonstrating the knowledge and understanding of green building practices and principles needed to support the use of the LEED<sup>®</sup> 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><i>Mahesh Ramarajan</i></p> <hr/> <p>MAHESH RAMARAJAN PRESIDENT &amp; CEO, U.S. GREEN BUILDING COUNCIL PRESIDENT &amp; CEO, GREEN BUSINESS CERTIFICATION INC.</p>

	
<p><b>GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT</b></p>	
<p><b>GRIHA CERTIFIED PROFESSIONAL CERTIFICATE</b></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</p> <p>Note : This certification is valid only for GRIHA version 2015.</p>	<p><i>[Signature]</i></p> <p>Chief Executive Officer GRIHA Council</p>

