

TECHNICAL REPORT OF GREEN CAMPUS AUDIT



Submitted to

**SREE ABIRAAMI ARTS AND SCIENCE COLLEGE
FOR WOMEN, GUDIYATTAM - 635803,
VELLORE DISTRICT, TAMIL NADU, INDIA.**

Date of Audit: 07.12.2020 (Monday)

Submitted by



NATURE SCIENCE FOUNDATION
*A Unique Research and Development Centre for
Society Improvement)*

An ISO 9001:2015 Certified Organization
LIG-II, 2669, Gandhi Managar, Peelamedu
Coimbatore - 641 004, Tamil Nadu, India.

Phone: 0422 2510006, Mobile: 9566777255, 9566777258
Email: director@nsfonline.org.in, directornsf@gmail.com



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1. Introduction

Green campus is an area of the Organisation or the Organisation as a whole itself contributing to have an infrastructure or development that is structured/planned to incur less energy, less water, less or no CO₂ emission and less or pollution free environment (Aparajita, 1995). Green Campus Audit is a tool to evaluate environment management system which is systematically executed to protect and preserve the environment. Green campus audit constitutes the environmental friendly practices and education combined to promote sustenance of green environment adopting user-friendly technology within the campus. It creates awareness on environmental ethics, resolves environmental issues and offers solutions to various social and economic needs (APHA, 2017). It strengthen the concept of “Green building” and “Oxygenated building” which in turn provides a healthy atmosphere to the stakeholders.

Green Campus Audit ensures the Organization’s campus should be greenish with large diversity of trees, herbs, shrubs, climbers and lawns to reduce the environmental pollution and soil erosion; it is also useful in relation to biodiversity conservation, landscape management, irrigation/economic water utilisation and maintenance of natural topography and vegetation (Gowri and Harikrishnan, 2014, Aruninta *et al.*, 2017). The maintenance of an eco-friendly campus ensures a neat and clean environment. For the benefit of stakeholders, solid waste management, recycling of water, disposal of sewage and waste materials (electronic and biomedical wastes), ‘zero’ use of plastics, etc. should be followed consistently in the organization campus.

Green Campus Audit procedures includes the definition of green audit, methodology on how to conduct Green audit at Educational Institutions and Industrial sectors as per the checklist of Environment Management Systems and International Standards on ISO 14001:2015, Indian Green Building Council, Swachh Bharath Scheme under Clean India Mission to understand the principles and importance of various audits in the context of the organization and risk assessment at 360° views (Gnanamangai *et al.*, 2020). Green campus audit helps the educational institutions/ industries to maintain eco-friendly environment, assures personal hygiene to various stakeholders and supports the nation; on the whole for the noble cause of environmental protection and nature conservation which in turn enhances the quality of life of all living beings (Arora, 2017).

2. Role of Educational Institutions in India

Educational institutions are playing important role in a nation’s growth and development which starts from maintenance of green campus without harming the environment. A clean and healthy environment in an Organization determine effective learning skills and offers a conducive learning environment to the students. Educational institutions are insisted by both Central and State Governments to offer eco-friendly atmosphere to the stakeholders. In addition, all the Educational institutions are asked to save the environment for future generations and to resolve the environmental problems (accumulating solid wastes and wastewaters/effluents and their careless disposal, enormous utility of plastics, uneconomical consumption of water, irresponsible in water harvesting and storage procedures, etc.) through

Environmental Education. Implementing Swachh Bharath Abhiyan Scheme launched by the Indian Government thro' the Educational institutions plays a major role in terms of giving neat and clean environment to tribal, rural and urban people across the country, besides the regular and conventional activities carried out by NSS, NCC/Student Force, Nature club, Eco club, Science club, Fine Arts club, Flora and Fauna club, Youth Red cross unit, etc. Seminar, Conference, Workshop, training and awareness programmes on Biodiversity conservation education, environmental awareness programmes, etc. may be conducted periodically by the Management and Administrative people of an Organization to the stakeholders.

Green campus auditing is a systematic method whereby an organization's environmental performance is checked against its environmental strategies and compliances of the Government guidelines. This audit process is definitely useful for the Educational institutions to maintain the campus neatly and can give pure atmosphere to the students and staff members including Management people. It is like an official examination of the environmental effects on an organization's campus as per the Government guidelines. The audit report may be useful to improve the organization's campus significantly by following the recommendations and suggestions given in the report. The green campus audit processes are being undertaken by World / Indian Green Building Council (IGBC), Green Building Code and Green Ratings Systems (GBCRS), Green Rating for Integrated Habitat Assessment (GRIHA), Consideration of Indian Industry GreenCo Rating System (CII-GreenCo) and Associated Chambers of Commerce and Industry of India (ASSOCHAM) along with ISO EMS 14001:2015 criteria and the concept of Swachh Bharath Abhiyan under Clean India Mission

3. Green Campus and Environment Policy

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

4. Environment Friendly Campus

As stated earlier, Organization is liable to provide an eco-friendly atmosphere along with good drinking water facility to all the stakeholders (students and staff members). Manuring the cultivated plants/grown within the campus may applied with organic manure, cow dung, farmyard manure and vermicompost instead of using chemical fertilizers. All non-compostable and single-use disposable plastic items,

plastic utensils, plastic straws and stirrers should be avoided. Demonstration/awareness programme on establishing plastic-free environment and utility of organic alternatives for all incoming and current students, staff and faculty should be organised. Reduction of use of papers alternated with e-services, e-circulars, etc. and proper disposal of wastes, recycling and suitable waste management system should be considered to establish environment friendly campus.

5. Aims and Objectives of Green Campus Audit

- To recognise the initiatives taken towards establishing the green campus in terms of gardening.
- To grow a large number of oxygen releasing and carbon dioxide assimilating plants in the campus to give a pure atmosphere to the stakeholders.
- To identify and provide baseline information to assess threat and risk to the ecosystem due to Organization development.
- To recognise and resolve different environmental threats of the Organization.
- To ensure proper utilization of resources available in the surrounding areas towards future prosperity of the humanity.
- To fix a couple of norms for disposal of all varieties of wastes and use green cover as a carbon sink for pollution free air.
- To assess the greenish nature of an Organization campus in terms of trees, herbs, shrubs, climbers, twins, lianas, lawns and reflected in reducing the environmental pollution soil erosion, biodiversity conservation, landscape management, natural topography and vegetation.

6. Importance of Green Auditing

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

Green campus audit may be beneficial to the campus in improving the greenery activities which in turn useful to save the planet for future generation. Green campus audit is a kind of professional care and a simple indigenized system about the environment monitoring in terms of planting a huge number of trees which is a duty of each and every individual who are the part of economical, financial, social, and environmental factors. It is necessary to conduct green audit frequently at least once in three years in campus because students and staff members should aware of the green

audit and its beneficial effects in order to save planet by means of ‘Go green concept’ which in turn support the institution to set environmental models (‘icon’) for the community. Green audit is a professional and useful measure for an Organization to determine how and where they are retaining the campus eco-friendly manner. It can also be used to implement the alleviation measures at win-win situation for the stakeholders and the planet. It provides an opportunity to the stakeholders for the development of ownership, personal and social responsibility.

7. Benefits of the Green Auditing

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

- Know the status of development of internal and external Green campus audit procedures and implementation scenario in the Organization.
- Establishment of Green campus objectives and targets as on today as per the ‘Green and Environment Policy’, ‘Indian Biodiversity Act’ and ‘Wildlife Protection Act’ of the Ministry of Environment, Forests and Climate Change, New Delhi and World & Indian Green Building Council concepts in accordance with prevailing rules issued by the government/local authorities
- Assigning the roles and responsibilities to the Environmental Engineer and Agriculture Staff who are all responsible to improve green initiatives.
- Development of ownership, personal and social responsibility for the Organization and its environment and developing an environmental ethic and value systems to young generations.
- Enhancement of the Organization profile and reach the global standards in proving the green campus and eco-friendly atmosphere to the stakeholders
- Suggested of availability of Biogas plant to the management to restrict the usage of fossil fuel in cooking purposes.
- Implementing status of the rain harvesting system, water reservoirs, percolation pond, etc. in the campus to increase the ground water level.
- Establishment of terrace garden, herbal garden, kitchen, zodiac, ornamental gardens, etc. for enhancing teaching and learning and commercial exploitation.
- Treated water consumption towards plant cultivation, canteen, hostel, machinery cleaning, transport, toilet use and etc. on water consumption and per capita water consumption per day calculation.
- Studying the campus flora by making a complete data on total number of both terrestrial and aquatic plants, herbs, shrubs, climbers, twins and grasses.
- Survey of campus fauna by conducting the number living and visiting animals, insects, flies, moths and worms in the campus.
- Documentation of the number of oxygen releasing and carbon dioxide assimilating plants planted in the campus to give pure atmosphere to the

stakeholders.

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

- Recommendations for improving the green initiatives, planning and efforts in the campus after audit report to improve further.

8. About the Organization

8.1. Sree Abiraami Arts & Science College for Women

Sree Abiraami Arts and Science College for Women (SAWC) was established in the year 2016. The aim of the institution is to “Empower Women through Quality Education” to the socially and economically backward female students of this region. The college is run by Sree Abiraami Educational and Charitable Trust, Gudiyattam approved by Government of Tamil Nadu and affiliated to Thiruvalluvar University, Vellore. This is the first women institution in Gudiyattam located in Keelalathur Village on Gudiyattam to Katpadi main road, just about 30 Km from Vellore, a health and educational hub.

The college is situated in serene and greenish atmosphere with high-tech infrastructure and spacious class rooms enabled with ICT facility, well equipped laboratories, computer lab, digital library, 24 X 7 Wi-Fi accessibility and hygienic canteen. 30 buses are operated covering 70 Km radius from the college for the benefit of the students.

The college offers 8 UG Programs and 2 PG Programs. The management and the faculty members are dedicated in creating the environment which supports the vision of the college. In order to achieve this goal, the institution conducts seminars, guest lectures, conferences, symposium and other activities in regular intervals.

8.2. About Nature Science Foundation (NSF)

NSF is a Non-Profit ISO 9001:2015 certified Organization and registered with NGO Darpan NITI Aayog and Ministry of Micro, Small and Medium Enterprise, Government of India functioning energetically towards the noble cause of nature conservation and environmental protection. NSF is managed by a board of trustees of NSF Public Charitable Trust under the TN Societies registration Act 1975 (TN Act 27 of 1975) on 29th November, 2017 at Peelamedu, Coimbatore- 641 004, Tamil Nadu, India with Certificate of Registration No. 114 / 2017. In addition, NSF has 12A, 80G and Form 10AC certificates for income tax exemption. 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’. NSF family is wide spread across India with over 70 state-wise Lead auditors to conduct Green and Environment Audits.

NSF is functioning strenuously to conduct different awareness programmes and implement various schemes to public and school / college students towards the noble cause of nature protection. Some of the programmes are also being organized for the benefit of tribal communities to create the supply chain for biodiversity conservation studies. The objectives along with vision and mission are illustrated to promote educational and environmental awareness programmes through social activities for enhancing the quality of life and to conserve nature from environmental

pollutants using traditional and modern technologies for sustainable land management. NSF is educating the tribal community children through social service and towards the upliftment of tribes as a whole and make them as entrepreneurs.

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

In order to encourage the students, members of faculty, academicians, scientists, entrepreneurs and industrial experts those who are involving in nature protection and biodiversity conservation studies, 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' will be given.

NSF has introduced various types of Audits such as 'Eco Audit', 'Green Audit', 'Energy Audit' and 'Hygienic Audit' 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 EMS 14001:2015 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, MoU, International Eco Club student Chapter Certificate will be given to get the maximum mark weightage in NAAC. Audit processes are being conducted through the certified Auditors as per the following

| Audit | Certified Auditors | Certified Auditors |
|--------------|---|--|
| Green Audit | <ul style="list-style-type: none"> • IGBC - Indian Green Building Council • GBCRS - Green Building Code and Green Ratings Systems • GRIHA – Green Rating for Integrated Habitat Assessment | <ul style="list-style-type: none"> ➤ Mrs. S. Rajalakshmi ➤ Dr. R. Mary Josephine ➤ Dr. B. Mythili Gnanamangai ➤ Er. Ashutosh Kumar Srivastava ➤ Er. N. Shanmugapriyan |
| Energy Audit | <ul style="list-style-type: none"> • BEE - Bureau of Energy | <ul style="list-style-type: none"> ➤ Er. D. Dinesh kumar |

| | | |
|----------------------------------|--|--|
| | <p>Efficiency</p> <ul style="list-style-type: none"> • LEED - Leadership in Energy and Environmental Design • CII-GreenCo – GreenCo Rating System Felicitator | <ul style="list-style-type: none"> ➤ Er. N. Shanmugapriyan ➤ Dr. N. Balasubramaniam ➤ Dr. P. Thirumoorthi ➤ Dr. G. Murugananth |
| Environment Audit | <ul style="list-style-type: none"> • IGBC - Indian Green Building Council • ASSOCHAM - Associated Chambers of Commerce and Industry of India • FSRS – Fire Safety & Rescue Services | <ul style="list-style-type: none"> ➤ Mrs. S. Rajalakshmi ➤ Dr. A. Geetha Karthi ➤ Dr. R. Mary Josephine ➤ Dr. B. Mythili Gnanamangai ➤ Er. Ashutosh Kumar Srivastava ➤ Er. N. Shanmugapriyan |
| Hygiene Audit | <ul style="list-style-type: none"> • FSMS – Food Safety Management System & • Occupational Safety & Health (ISO 22000:2018) • SBICM - Swatch Bharath under India Clean Mission | <ul style="list-style-type: none"> ➤ Mrs. Gaanaappriya Mohan ➤ Er. Ashutosh Kumar Srivastava ➤ Dr. R. Sudhakaran ➤ Dr. N. Saranya |
| Waste Management Audits | <ul style="list-style-type: none"> • Water Audit, Soil Audit, Biomedical Waste Audit, Solid Waste Management Audit as per the IGBC, GRIHA and BEE | <ul style="list-style-type: none"> ➤ Mrs. Gaanaappriya Mohan ➤ Er. Ashutosh Kumar Srivastava ➤ Dr. R, Sudhakaran ➤ Er. N. Shanmugapriyan |
| Academic & Administrative Audits | <ul style="list-style-type: none"> • Academic & Administrative Audits as per the NAAC Criteria | <ul style="list-style-type: none"> ➤ Dr. B. Anirudhan ➤ Dr. B. Shreeram |

Table 1. The SAWC Campus facility details

| S.No. | Details of Area | Total area |
|-------|--------------------------|-------------|
| 1. | Total Campus area | 42492 sq.m |
| 2. | Total Built up area | 20146 sq.m |
| 3. | Covered Car parking area | 500 sq.m |
| 4. | Air-conditioned area | 4000 sq.m |
| 5. | Non-Airconditioned area | - |
| 6. | Gross Floor area | 5000 sq.m |
| 7. | Public area | - |
| 8. | Service area | - |
| 9. | Forest vegetation | |
| 10. | Planted vegetation | 4020 sq. ft |

9. Audit Details

| | |
|--|--|
| Date / Day of Audit | : 07.12.2020 (Monday) |
| Venue of Audit | : Sree Abiraami Arts and Science College for Women, Katpadi Road, Keelalathur, Gudiyattam - 635803, Vellore District, Tamil Nadu, India. |
| Audited by | : Nature Science Foundation, Coimbatore - 641 004, Tamil Nadu, India. |
| Audit type | : Green Campus Audit |
| Name of ISO EMS Auditor | : Mrs. S. Rajalakshmi, Chairman, ISO QMS & EMS Auditor, NSF. |
| Name of Subject Expert-I | : Dr. D. VinothKumar Joint Director, NSF |
| Name of IGBC AP Auditor | : Dr. B. Mythili Gnanamangai, IGBC AP, Indian Green Building Council. Ms. Burra Hema Malini IGBC AP, Indian Green Building Council. |
| Name of ASSOCHAM Auditor | : Er. Ashutosh Kumar Srivastava, Associated Chambers of Commerce and Industry |
| Name of Eco & Green Officer | : Ms. V. Sri Santhya, Eco & Green Council Programme Officer, NSF. |

10. Procedures followed in Green Campus Audit

Green campus audit is a structured process of documenting the credentials in terms of number of trees, herbs, shrubs, lawns, climbers and lianas reflected in reducing the environmental pollution and soil erosion and useful for biodiversity conservation, landscape management, natural topography and vegetation. It is a kind of a professional tool for assessing the green campus. Green audit projects the best environmental practices and initiatives taken in the organisation at the prescribed site of audit that brings added value to the organisation in maintaining the eco-friendly campus to the stakeholders. First step of the audit is ensuring that the organisation has a central role in building the green campus, in order to validate the same (Adeniji, 2018).

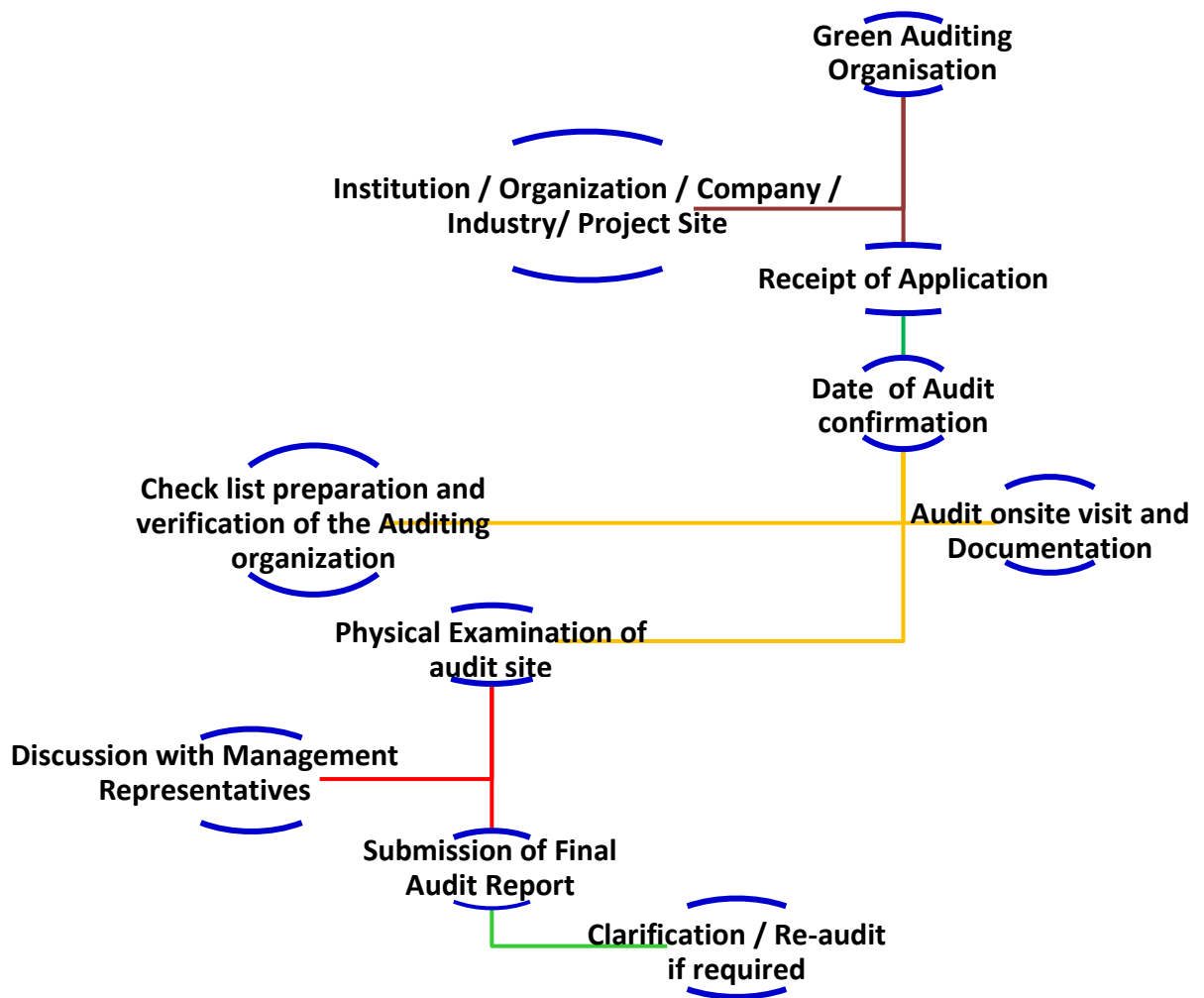
Green campus is not intended for the self-sustainability of the building alone, it also involves in propagation of the green campus initiatives so as to be adopted by any individuals and organization at a minimum cost. Green campus audit has been conducted as per the checklist of Nature Science Foundation, Coimbatore, Tamil Nadu, India (www.nsfonline.org.in) through the authenticated Professionals for people qualified to investigate and evaluate the campus for validating the best environmental practices (Staniskis and Katiliute, 2016, SCSR, 2018). Professional team of ISO Environment Management Audit (14001:2015), Indian Green Building Council Accredited Professionals, Experts of Green campus Lead Auditors and Botanists / Zoologists / Biotechnologists were selected to conduct the Green campus audit process.

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

within the campus were recorded. Establishment of lawns, trees, herbs, shrubs and climbers and establishment of terrace / kitchen / herbal / zodiac / ornamental / medicinal garden / aquarium and aquatic (hydrophytes) plants in the campus were recorded. Labelling of common names and Botanical names of plants were observed. The operation of the water irrigation system, drip and sprinkler irrigation methods and use of recycled water for irrigation purpose or any other purpose in the campus area were noted. The number of water wells, bore wells and water reservoir facilities in the campus were also noted as per the Audit Manual of Gnanamangai *et al.* (2020).

Attempts made for water scarcity during summer season towards the maintenance of plants and frequency of watering for plantations in the campus were noted. Biodiversity conservation education, projects, awareness programmes, etc., through Indian Biodiversity Act and Ministry of Environment, Forests and Climate Change, Government of India and the conduct of outreach programmes for dissemination of Green campus motto were recorded (Venkataraman, 2009). Conduct of outreach programmes for dissemination of Green campus motto to the students and staff members including public domain and signing of MoU with Government and Non-Governmental Organizations to ensure green campus activities for future generation were noted (Lauder *et al.*, 2015; Brindusa *et al.*, 2007). Technology driven solutions initiated by the Green campus organization can also be disseminated and documented successively for propagating the attitude of the Green campus in wider masses.

Projects, Dissertations and Thesis are the academic effort credentials that always fosters the innovative ideas on thinking and implementation of new innovative approaches towards the green campus. These should be disseminated through presentations and publications in social media, books, magazines and journals so as to spread the innovative ideas and methods to the broad public. These efforts taken by the students and staff were deliberated while conducting the Green campus audit. Green audit processes are taking place as per the following flow-chart starting from the receipt of application forms from the auditee (organization) and ending upon the submission of final report to the concerned organization (Leal Filho *et al.*, 2015). During the audit process, the best environmental / greenery practices followed and new initiatives undertaken in the organisation to reduce the environmental pollution and steps taken for nature conservation that brings added value to the organisation in maintaining the eco-friendly campus were assessed (IGBC, 2020; WGBC, 2020). In addition, supporting activities of the scholars and staff with regard to “Vision and Mission” of the greenery activities of the Organization is also evaluated.



Flow-chart of Green Campus Audit Procedures

10.1. Onsite Green Campus Audit activities

1. Opening meeting is the first step between the audit team and auditee along the Management Representatives where the purpose of the audit, procedures to be adopted for the conduct of the audit, verification of the documents and the time schedules were discussed, in brief.
2. Followed by opening meeting, onsite inspection will be conducted which is the second step in the audit where the Audit team members visited different sites in the SAWC Campus and required photographs were taken then and there for preparing the audit report.
3. During the onsite phase of visit, it is vivid how the various facilities made by the SAWC Management to the stakeholders without disturbing the landscape, natural topography and vegetation to ensure the green campus.
4. It is observed how the environment is protected in the campus and by what means an eco-friendly atmosphere is being given to the stakeholders. The assessment reveals the strengths and weaknesses of the Auditee's Management controls and risks associated with their failure in creating Green campus facilities.

5. Collecting audit proofs *ie*, data collection and information from the auditee as per the audit protocol were carried out.
6. An exit meeting was conducted to describe the findings of the audit with Management Representatives and staff members along with the audit team in brief.

10.2. Pre-Audit stage activities

A pre-audit meeting (opening meeting) is conducted with Management and Administrative people along with staff coordinators of Energy and Environment audit process, wherein, audit protocol and audit plan were discussed in brief. The purpose of this meeting is to provide a chance to emphasize the scope and objectives of the audit and discussions held on the feasibilities associated with the audit (Marrone *et al.*, 2018). Pre-audit stage activities are an essential prerequisite for the green audit to meet the auditee and to gather information about the campus and required documents were collected directly from the Organization before the start of the audit processes (Fachrudin *et al.*, 2019). Audit team was selected by the Nature Science Foundation as per the checklist comprised of Lead Auditor of ISO (EMS 14001:2015), Botanist, Agriculture and Horticulture Scientists from Conventional and Technical Universities across India, Accredited Professionals from Indian Green Building Council, Hyderabad and Associated Chambers of Commerce and Industry of India, New Delhi.



Opening meeting with the College Principal, IQAC Coordinator, Staff Coordinators and Audit Team of the Nature Science Foundation, Coimbatore, Tamil Nadu

Energy and Environment audit activity at the SAWC Campus by the NSF Audit Team



10.3. Target Areas of Green Auditing

Green campus audit is nothing but a professional tool to assess the greenery activities in the educational institutions and give a value addition to the campus and considered as a resource management process. Eco-campus concept mainly concentrate on the efficient use of energy and water; minimize waste generation or pollution and also improve the economic efficiency. Green campus audit process may be undertaken at frequent intervals and their results can demonstrate improvement or change over time. Eco-campus focuses on the reduction of carbon emissions, water consumption, wastes to landfill and enhance energy use conservation to integrate environmental considerations into all contracts and services considered to have significant environmental impacts (Choy and Karudan, 2016).

There are several target listed in the Green audit process in which a few are taken into consideration as per the Indian scenario is concerned. They are water use efficiency, energy use efficiency, solid, e-waste biomedical, food, sewage waste management and reuse methods, planting of oxygen releasing and carbon dioxide assimilating plants, landscape management, topology, vegetation, soil erosion control, carbon footprint due to use of vehicles, electricity and fossil fuels (León-Fernández and Domínguez-Vilches, 2015). drinking water quality supply, Biogas plant, rain harvesting system, water reservoirs, percolation pond, establishment of various herbal, terrace and ornamental, gardens, campus and flora fauna, water irrigation, implementation of Government schemes, conduction of awareness programmes management, public transport, low-emitting vehicles and control of car smokes and exhaust, Organization's budget for greenery activities, campus facilities for disabled, persons needs special attention and or maternity care, security, safety and health infrastructure facilities for stakeholder's wellbeing (Nunes *et al.*, 2018).

10.4. Flora and Fauna diversity of study area

The SAWC Campus is situated at Gudiyattam, Vellore. The campus is planted with many flowering and non- flowering plants. The green vegetation is also utilized in growing farm animals. The campus is also enriched with many birds and butterflies. Thereby the campus provided the stakholders with clean and green environment. Study/documentation of biodiversity provides a useful measure of the quality of the environment and the ecological studies are important aspects of environment, in view of the consideration of environmental quality and natural flora and fauna conservation.

10.4.1. Topography

The SAWC coordinates at 78° 52' E of longitude and 12° 56' N latitude. SAWC is located at Gudiyattam which is a municipality in Vellore district in the state of Tamil Nadu in India. It lies between Bangalore and Chennai.

10.4.2. Geology and Soil condition

Vellore district (in Tamil Nadu State) is bound by Andhra Pradesh State towards its North, Thiruvannamalai district (Tamil Nadu) in the South, Tiruvallur district in the North East, Kancheepuram district in the South East while Krishnagiri district in the Southwest. Major towns in the district are Ambur, Arcot, Wallajapet,

Arakonam, Jolarpet and Sholinghur. Soil found in Vellore is chiefly red loam soil. However, other type of soils are also found in some regions which include gravelly, stony, sandy loam soil, black loam soil and sand clay loam. The type of soil found on the banks of Palar river includes Alluvium soil.

10.4.3. Climatic conditions

Vellore experiences low rainfall (996.7 mm annual rainfall) is throughout the year with semi-arid climate. It lies in the Eastern Ghats region, on the banks of Palar river. It is not rich in mineral resources and its topography is almost plain with slopes from East to West. Located just 135 kms. (85 miles) from Chennai, the city encounters high temperature throughout the year. During summers, humidity ranges from 40%–63% while during winters, it ranges between 67%–86%. Temperature in Vellore ranges from a maximum of 40.5°C (104.9°F) to a minimum of 18.4°C (65.1 °F). Vellore receives of rainfall every year due to southwest monsoon which brings scanty rainfall between the months of June and August.

Table 2. Soil edaphic and environmental parameters of the SAWC Campus

| S.No | Details of Parameters | Data collected |
|---------------------------------|---------------------------|------------------------|
| Soil edaphic parameters | | |
| 1. | Soil pH | 6.5 – 7 |
| 2. | Soil types | Red loam soil |
| 3. | Total organic carbon | 0.3% |
| 4. | Electrical conductivity | 2.16 ds/m |
| 5. | Water holding capacity | 70.23% |
| 6. | Total Nitrogen | 100- 300 Kg/hect |
| 7. | Available Phosphorous | 10 - 15 Kg/hect |
| 8. | Exchangeable Potassium | 100 – 200 Kg/hect |
| Environmental parameters | | |
| 1. | Minimum Temperature | 13- 27°C |
| 2. | Maximum Temperature | 29-39.4°C |
| 3. | Minimum Relative humidity | 41% |
| 4. | Maximum Relative humidity | 70% |
| 5. | Annual Average Rainfall | 40.71 inches /avg.year |
| 6. | Annual Average Sunshine | 109.3 hrs/avg.month |
| 7. | Wind speed | 8.7-11.4 miles/hr |

11. Identification of Plant Species

11.1. Identification of Flowering Plant Species

Various vascular plant species were collected across the SAWC Campus and subjected to botanical identification (botanical name, family, habitat, and economic importance) and anthropogenic disturbances to the natural vegetation in campus. Plants were freshly collected and their digital photographs were also taken. The collected plant specimens have been identified using taxonomic literatures (Gamble and Fischer, 1972; Matthew, 1983; Nair and Henry, 1983; Henry *et al.*, 1989; Chandrabose and Nair, 1988). Further, their identification was confirmed by matching with authentic specimens in the Madras Herbarium (MH), Botanical Survey of India (BSI), Southern Circle, Coimbatore, Tamil Nadu, India.

11.2. Identification of Non-Flowering Plant Species

11.2.1. Lichen Identification

Lichen specimens were collected from SAWC Campus and then identified based on the lichen identification key of Awasthi (2007). Representative lichen specimens were identified based on thalli morphology such as rhizine, cilia and pseudocephellae and reproductive structures (fruiting bodies) such as apothecia, perithecia, soredia, soralia, conidia and isidia embedding on the thalli surface using a stereo microscope (CZM4, Labomed, India). In the present study, Anatomy of the thallus were carried out in order to document micro morphological features such as medulla thickness, upper and lower surface of thallus, lobes, size and shape of spores. Thin section of apothecia and perithecia was made to observe the nature ascus spores and the arrangement of the algal and fungal layers in the thallus; respectively. Spot tests featured the use of chemical reagents to detect lichen substances by appearances of the characterized colour changes on lichen thallus was noted. The lichen chemistry was analyzed according to Culberson and Kristinson (1970) methods. The colour spot test was done on medulla of lichen thallus using test reagents of potassium hydroxide (K), calcium hypochlorite (C) and paraphenylene di amine (PD). Lichen was identified based on colour spot test using the procedure defined by Orange *et al.* (2001).

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

11.2.3. Identification of Algae Genera

Algae are the members of a group of predominantly aquatic photosynthetic organisms of the kingdom *Protista* followed by terrestrial algae found in freshwater and slump areas. Algae are non-flowering and lower group of plants which are green in colour because of presence of chlorophyll pigments in the body called thallus. Algae adopt diverse life cycles, and by size, they range from microscopic *Microsomonas* 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 abiotic factors as the independent variable (Jayson and Mathew, 2000).

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

13. Green Campus Audit Observations

It covers both qualitative and quantitative measurements including physical observation of greeneries in terms of growing of terrestrial and aquatic plants, animals and microflora in natural and planted vegetation and their maintenance. Topography, landscape management design and soil erosion control are playing important role in environment sustainable development in the campus. An account of a large number of Oxygen releasing and Carbon dioxide assimilating plants planted in the Campus are taken into consideration to give pure atmosphere to the stakeholders. Establishment of

different types of gardens in the campus, rainwater harvesting system, operation of water irrigation, drip and sprinkler irrigation methods may be adopted to improve the green campus. Similarly, biodiversity conservation strategies are very essential to conserve a variety of plant and animal species in the campus ecosystem. Biofertilizers, organic and green manures, cow dung manures and farmyard manures may be used for the cultivation of plants which may be protected the environmental health that will not cause any air, water and soil pollution. The various Clubs, Forums, Cells, Associations and Student / Staff Chapters such as Eco club, Nature club, Science club, Fine Arts club, Flora and Fauna club, Youth Red Cross, NCC/Student Force and NSS bodies may be involved in green campus initiatives, planning and efforts among stakeholders. Outreach programmes may be conducted for dissemination of Green Campus motto and Green pledge initiatives to rural, tribal and urban people. Academic credentials like taking up major and minor Projects, Dissertations and Thesis work by the students and staff members may be taken into account towards green campus initiatives, planning and efforts. Best practices followed on green campus initiatives in the Organization and recommendations for greening are illustrated in the audit report as well.

Table 3. Qualitative Measurements of Green Auditing

| S.No | Requirements and checklists of the audit | Conformity | | |
|------|---|------------|----|----|
| | | Yes | No | NA |
| 1. | Have internal Green campus audit procedures been developed and implemented in the Organization? | ✓ | | |
| 2. | Have programmes for the achievement of Green campus objectives and targets been established and implemented as on today? | ✓ | | |
| 3. | Whether Green campus audit and Environment audit are simultaneously carried out or separately carried out? | ✓ | | |
| 4. | Whether Indian Biodiversity Act as per the Ministry of Environment, Forests and Climate Change, New Delhi, Wildlife protection act and World & Indian Green Building Council concepts followed? | ✓ | | |
| 5. | Have responsibilities been assigned for programmes at each appropriate function and level? (Environmental Engineer & Agriculture Staff working for environment monitoring) | ✓ | | |
| 6. | Are the following environmental aspects considered in sufficient detail? | | | |
| | a. Drinking water / RO water / Borewell water / Open well water / Pond water / Municipal or Corporation water use and to check quality of water through Physico-chemical properties analysis | | ✓ | |
| | b. Wastewater treatment facility | | ✓ | |
| | c. Sufficient number of trees, shrubs, herbs and lawns | ✓ | | |
| | d. Solid waste management facility | | ✓ | |
| | e. Availability of Biogas plant | | | ✓ |
| | f. Rain harvesting system, water reservoirs, etc. | | ✓ | |

| | | | | |
|-----|---|---|---|--|
| | f. Aquarium and aquatic (hydrophytes) plants | | ✓ | |
| | g. Establishment of terrace garden, herbal garden, kitchen, zodiac, ornamental gardens, etc. | | ✓ | |
| | h. Natural Topography or Forest, Planted vegetation | | ✓ | |
| | i. Water well, Bore well, lake, water reservoir facility | ✓ | | |
| | j. Water consumption towards plant cultivation, canteen, hostel, machinery cleaning, transport, toilet use | ✓ | | |
| | k. Treated water consumption towards plant cultivation, machinery cleaning, transport, toilet use and etc. | | ✓ | |
| | l. Per capita water consumption per day calculated (45L/P/C/D) | | ✓ | |
| 7. | Whether plants are tagged properly with their common name and Botanical name for stakeholders? | | ✓ | |
| 8. | Signing of MoU with Govt. and NGOs to disseminate Green campus motto and pledge | ✓ | | |
| 9. | Biodiversity conservation of plants, animals and wildlife, genetic resources (Endangered and endemic species) at each appropriate function and level? | | ✓ | |
| 10. | Are any biofertilizers, organic manures, farmyard manures, vermicompost, green manures and chemical fertilizers used for maintaining plants? | ✓ | | |
| 11. | Establishment of herbal garden, zodiac garden, medicinal garden, kitchen garden, terrace garden and ornamental plants garden in the campus | | ✓ | |
| 12. | Implementation of Government schemes (Swatch Bharath Abhiyan under Clean India Mission) | ✓ | | |
| 13. | Functioning of Nature club, Eco club, Cell, Forum, Association, NCC/Student Force, NSS bodies and Social Service League for students and staff members on biodiversity conservation, green campus development, etc. | ✓ | | |
| 14. | Conduction of awareness programmes and cultural activities on global warming, environmental changes and ecosystem maintenance to the stakeholders | ✓ | | |
| 15. | Conduction of outreach programmes for dissemination of green campus initiatives, natural resources, environmental pollution and biodiversity conservation to rural, tribal and urban people | ✓ | | |
| 16. | Implementation of composting pits, vermicompost unit, recycling of kitchen wastes collected from Hostels, Canteens, Cafeteria, Food court and other places | ✓ | | |
| 17. | Maintenance of plantations in the campus and steps taken for water scarcity during summer season to maintain plants | ✓ | | |
| 18. | Steps taken for organic, inorganic, toxic, e-waste, biomedical, food, sewage waste management, segregation of wastes and reuse methods | ✓ | | |

| | | | | |
|-----|---|---|--|--|
| 19. | Public transport, low-emitting vehicles and control of car smokes and exhaust towards environment monitoring | ✓ | | |
| 20. | Observation on the site preservation, soil erosion control and landscape management | ✓ | | |
| 21. | Projects and Dissertation works and Scholarly publications on environmental science and management carried out by students and staff members | ✓ | | |
| 22. | Implementation of advanced methods for watering plantations (Drip irrigation, Sprinkler irrigation, etc.) | ✓ | | |
| 23. | Use of metering for water utility, IoT based watering, automation, water device, remote water lines, etc. | ✓ | | |
| 24. | Percentage of Organization's budget for environment sustainability efforts | ✓ | | |
| 25. | Campus facilities for disabled, special needs and or maternity care including security, safety and health infrastructure facilities for stakeholder's wellbeing | ✓ | | |

Table 4. Quantitative Measurements of Green Auditing

| S.No. | Details of Plant and animal species | Numbers / Percentage |
|-------|---|--|
| 1. | Total number of Flowering plant species inside the Campus | 198 species belonging to 35 Genera under 27 families |
| 2. | Total number of Non-Flowering plant species inside the Campus | 8 species belonging to Lichens, Pteridophytes, Bryophytes and Mycoflora |
| 3. | Total number of living Mammals inside the Campus | 20 such as Cats, Cow, Dog, Goat and Squirrel |
| 4. | Total number of visiting Mammals inside the Campus | 2 species of bat, 5 species of Bonnet Macaque, 4 species of Indian Grey Mongoose |
| 5. | Total number of living Birds inside the Campus | 9 species including Common Myna, Barrow's Golden eye, Roch Pigeon, House crow Little Erget, Asian Koel and hens. |
| 6. | Total number of visiting Birds inside the Campus | 2 species including Coppersmith Barbet and Black – winged stilt |
| 7. | Total number of Aquarium | One with 5 -6 Golden fish Varieties |
| 8. | Total number of Aquatic (hydrophytes) plant species | Tow species belonging to <i>Lotus and Water Hyacinth,</i> |
| 9. | Total number of Grasshopper and Termites | Grasshopper: 4 species Termites: 3 species |
| 10. | Total number of Amphibians and Reptiles | Amphibians: 7 species Reptiles: 7 species |
| 11. | Total number of Butterflies and Mosquitos | Butterflies : 48 species Mosquitos: 02 species |

| | | |
|-----|---|--------------|
| 12. | Percentage of Forest Vegetation | 55% |
| 13. | Percentage of Planted Vegetation | 45% |
| 14. | Percentage of Water consumption to total human population | - |
| 15. | Percentage of Water consumption to total flora and fauna | - |
| 16. | Per capita water consumption per day | 3000 lit/day |

13.3. Flora and Fauna diversity in the SAWC Campus

13.3.1. Flora diversity in the SAWC Campus

13.3.1.1. Flowering plants diversity in the SAWC 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 SAWC Campus has more than 55.10 % of wild as well as native plant species and the other 48.89 % 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 55.10 % of the wild traits are leveraged for the native animals and birds. The most probable natural vegetation of SAWC campus is the semi – arid climate. The remnants of this past vegetation are found in the campus.

The most plants recorded are *Mangifera indica*, *Plumeria obtuse*, *Phoenix roebelenii*, *Dyopsis lutescens*, *Cocos nucifera*, *Dracaena reflexa*, *Tecoma stans*, *Cordia sebestena*, *Terminalia catappa*, *Cycas revoluta*, *Azadirachta indica*, *ficus benjamina*, *Artocarpus heterophyllus*, *Psidium guajava*, *citrus limon*, *Citrus reticulata* and *Manilkara zapota* are the dominant trees species characteristic to the vegetation within the campus. Some of the shrub species like *Rhapis excelsa*, *Furcraea foetida*, *Agave desmettiana*, *Aloe arborescens*, *Plectranthus amboinicus*, *Hibiscus rosa-sinensis*, *Lingustrum lucidum*, *Prunus cerasifera*, *Hamelia patens* and *Duranta erecta* are also rather common in the campus.

Ground flora is comparatively sparse, but fairly rich in undistributed areas. The campus was found to be free from weeds. Species such as *Cleome viscosa*, *Tradescantia spathaceae*, *Euphorbia hirta*, *Tephrosia purpurea* and *Aristida adcensionis* are some common herbs in the campus.

The common climbers found among the shrubs are *Epipremnum aureum* (Money plant) and *Jasmiun officinale* (Common Jasmine). The lawns at different sites were found to of *Aristida adcensionis* (Common needle grass). Number of above

species of trees and shrubs are 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 to protect the ones that grow naturally on the grounds upon the vegetation maintenance.

Invasive species

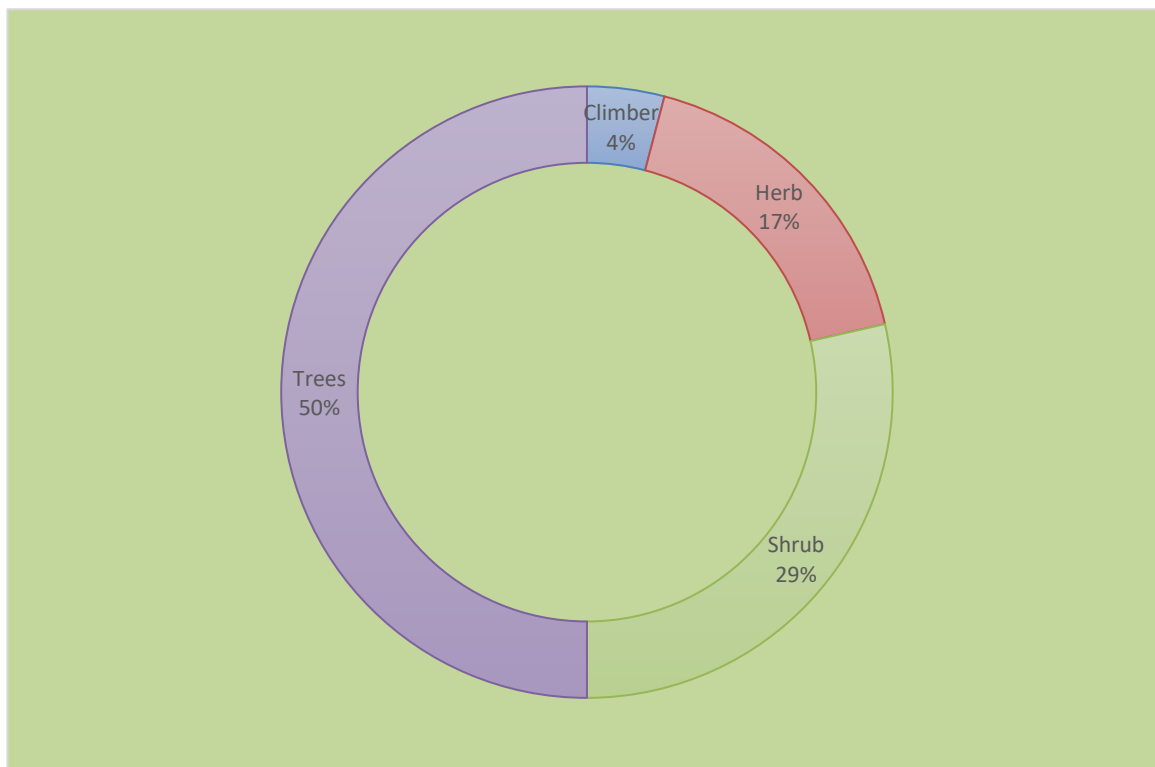
The campus has 16 invasive species such as *Taxus canadensis*, *Cycas revoluta*, *Euphorbia hirta*, *Lingustrum lucidum*, *Hamelia patens*, *Duranta erecta*, *Mangifera indica*, *Plumeria obtuse*, *Tecoma stans*, *Terminalia catappa*, *ficus benjamina*, *Psidium guajava*, *Manilkara zapota*, *Furcraea foetida*, *Dracaena reflexa* and *Cleome viscosa*. Invasive species are found to be disturbances to the natural setting in the vegetated areas.

The plantation species in the campus is of *Jasmiun officinale*, *Tephrosia purpurea*, *Rhapis excelsa*, *Plectranthus amboinicus*, *Hibiscus rosa-sinensis*, *Prunus cerasifera*, *Cordia sebestena*, *Azadirachta indica*, *Artocarpus heterophyllus*, *citrus limon*, *Citrus reticulata*, *Epipremnum aureum*, *Tradescantia spathaceae*, *Aristida adcensionis*, *Agave desmettiana*, *Aloe arborescens*, *Phoenix roebelenii*, *Dypsis lutescens*, *Cocus nucifera* and *Tabernaemontana divaricate*.

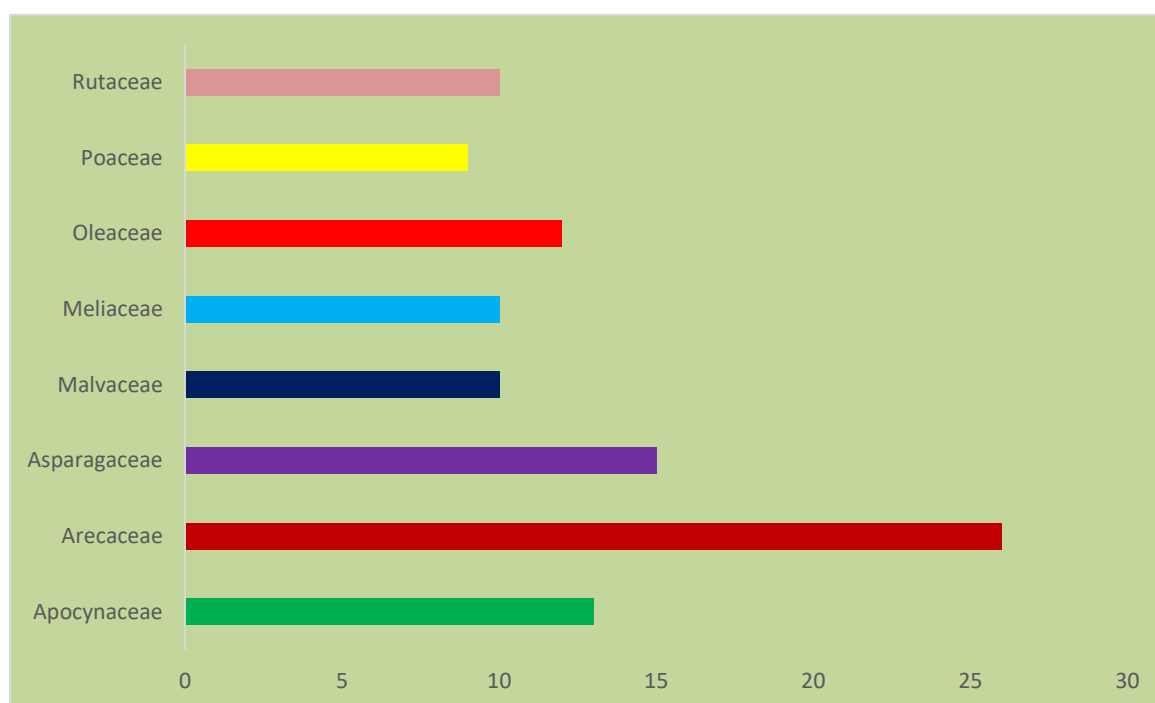
Some of the species are utilized as fruit yielding like *Mangifera indica*, *Psidium guajava*, *Manilkara zapota*, *Artocarpus heterophyllus*, *citrus limon*, *Citrus reticulata*, *Phoenix roebelenii*, *Cocus nucifera* and *Terminalia catappa* were found in the campus. Some of the medicinal plants like *Tabernaemontana divaricate*, *Phyllanthus niruri*, *Azadirachta indica* and *Euphorbia hirta* were also found in the campus.



Systematic groups of the plants in the SAWC Campus



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



Plant families with higher number of species in the campus area

The biodiversity of SAWC Campus comprises a sum of 196 species belonging to 35 genera under 27 families besides the lichens, mycoflora, pteridophytes and bryophytes. Among the documented higher plants, Dicots are dominating with 22 families followed by monocots (5 families). Over all analysis revealed that trees

were dominating flora (50%) followed by herbs, shrubs and climbers which accounts 28.57%, 17.34% and 4.08%, respectively. Among the documented dicots, Polypetalae formed a major proportion with 11 families, 11 genera and 67 species; Gamopetalae with 7 families, 9 genera and 52 species while Monochlamydeae with 3 families, 3 genera and 11 species. In monocots 5 families are spreading over 10 genera belonging to 64 species. Arecaceae is the first dominant family with 26 species followed by Asparagaceae with 15 species, Apocynaceae with 13 species, Malvaceae, Meliaceae and Rutaceae with 10 species, Oleaceae with 12 species and Poaceae with 9 species. At the time of green campus audit at SAWC Campus campus, a total of 74 invasive floral species were recorded. This clearly specified as the disturbances to the natural setting in the vegetated sector.

Table 5. List of Flowering plants in the SAWC Campus

| S.No | Common Name | Botanical Name | Family |
|------|---------------------|---------------------------------|---------------|
| 1. | Dwarf century plam | <i>Agave desmettiana</i> | Asparagaceae |
| 2. | Candelabra aloe | <i>Aloe arborescens</i> | Asphodelaceae |
| 3. | Jack fruit | <i>Artocarpus heterophyllus</i> | Moraceae |
| 4. | Common needle grass | <i>Aristida adensionis</i> | Poaceae |
| 5. | Neem tree | <i>Azadirachta indica</i> | Meliaceae |
| 6. | Lemon | <i>citrus limon</i> | Rutaceae |
| 7. | Mandarian orange | <i>Citrus reticulata</i> | Rutaceae |
| 8. | Asian spiderflower | <i>Cleome viscosa</i> | Capparidaceae |
| 9. | coconut tree | <i>Cocus nucifera</i> | Arecaeae |
| 10. | Geiger tree | <i>Cordia sebestena</i> | Boraginaceae |
| 11. | King sago | <i>Cycas revoluta</i> | Cycadaceae |
| 12. | Song - of - India | <i>Dracaena reflexa</i> | Asparagaceae |
| 13. | Golden dewdrops | <i>Duranta erecta</i> | Verbenaceae |
| 14. | Areca palm | <i>Dypsis lutescens</i> | Arecaceae |
| 15. | Money plant | <i>Epipremnum aureum</i> | Araceae |
| 16. | Asthma palnt | <i>Euphorbia hirta</i> | Euphorbiaceae |

| | | | |
|-----|--------------------|-----------------------------------|---------------|
| 17. | Weeping fig | <i>ficus benjamina</i> | Moraceae |
| 18. | Mauritius -hemp | <i>Furcraea foetida</i> | Asparagaceae |
| 19. | Red Head | <i>Hamelia patens</i> | Rubiaceae |
| 20. | Hawaiian hibiscus | <i>Hibiscus rosa-sinensis</i> | Malvaceae |
| 21. | Common Jasmine | <i>Jasmiun officinale</i> | Oleaceae |
| 22. | Lingustrum lucidum | <i>Lingustrum lucidum</i> | Oleaceae |
| 23. | Mango | <i>Mangifera indica</i> | Anacardiaceae |
| 24. | Sapodilla | <i>Manilkara zapota</i> | Sapotaceae |
| 25. | Roebelin palm | <i>Phoenix roebelenii</i> | Arecaceae |
| 26. | Cuban-oregano | <i>Plectranthus amboinicus</i> | Lamiaceae |
| 27. | Frangipani | <i>Plumeria obtusa</i> | Apocynaceae |
| 28. | Cherry plum | <i>Prunus cerasifera</i> | Rosaceae |
| 29. | Common guava | <i>Psidium guajava</i> | Myrtaceae |
| 30. | Bregu | <i>Rhapis excelsa</i> | Arecaceae |
| 31. | Crape jasmine | <i>Tabernaemontana divaricata</i> | Apocynaceae |
| 32. | Ground - hemlock | <i>Taxus canadensis</i> | Taxaceae |
| 33. | Yellow bells | <i>Tecoma stans</i> | Bignoniaceae |
| 34. | Purple tephrosoa | <i>Tephrosia purpurea</i> | Leguminosae |
| 35. | Tropical almomd | <i>Terminalia catappa</i> | Combretaceae |
| 36. | Boat lily | <i>Tradescantia spathaceae</i> | Commelinaceae |



Dracaena reflexa



Dypsis lutescens



Manilkara zapota,



Duranta erecta



Hibiscus rosa-sinensis



Mangifera indica



Tecoma stans,



Phoenix roebelenii



Tradescantia spathacea



Cycas revoluta



Ficus benjamina



Citru reticulata



Agave desmettiana



Artocarpus heterophyllus



Citrus limon



Cleome viscosa



Cocos nucifera

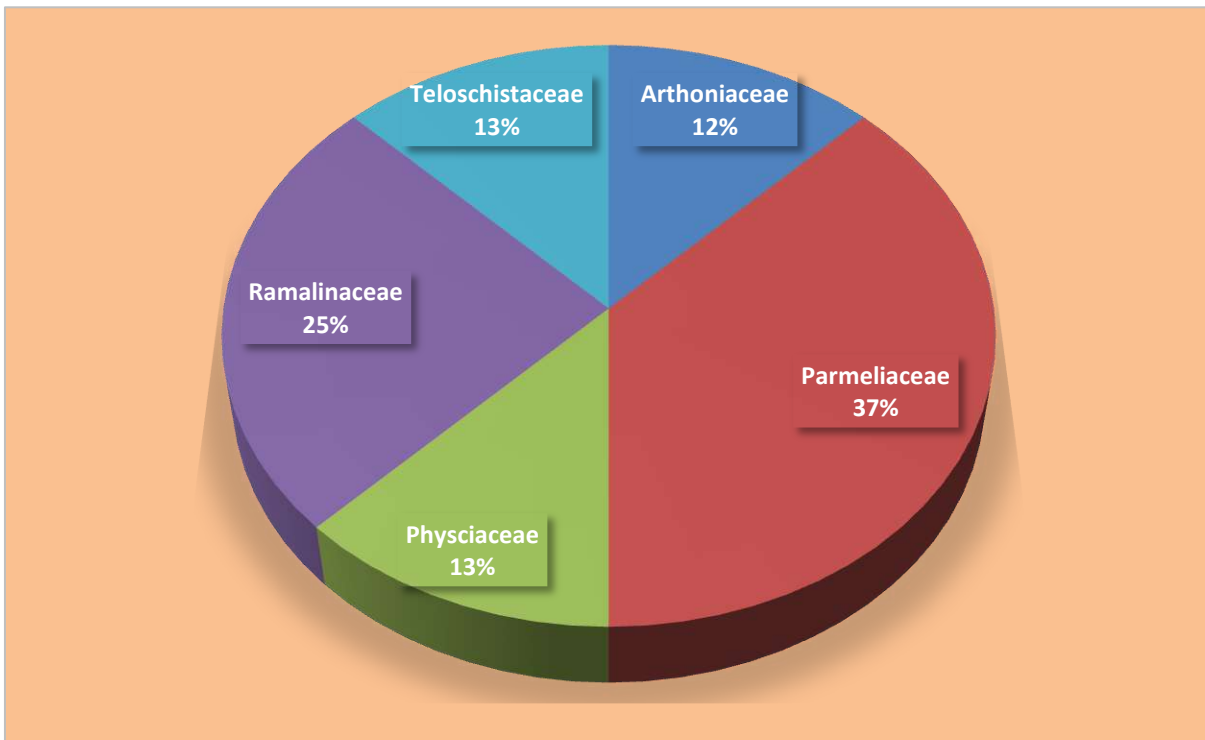


Cordia sebestema

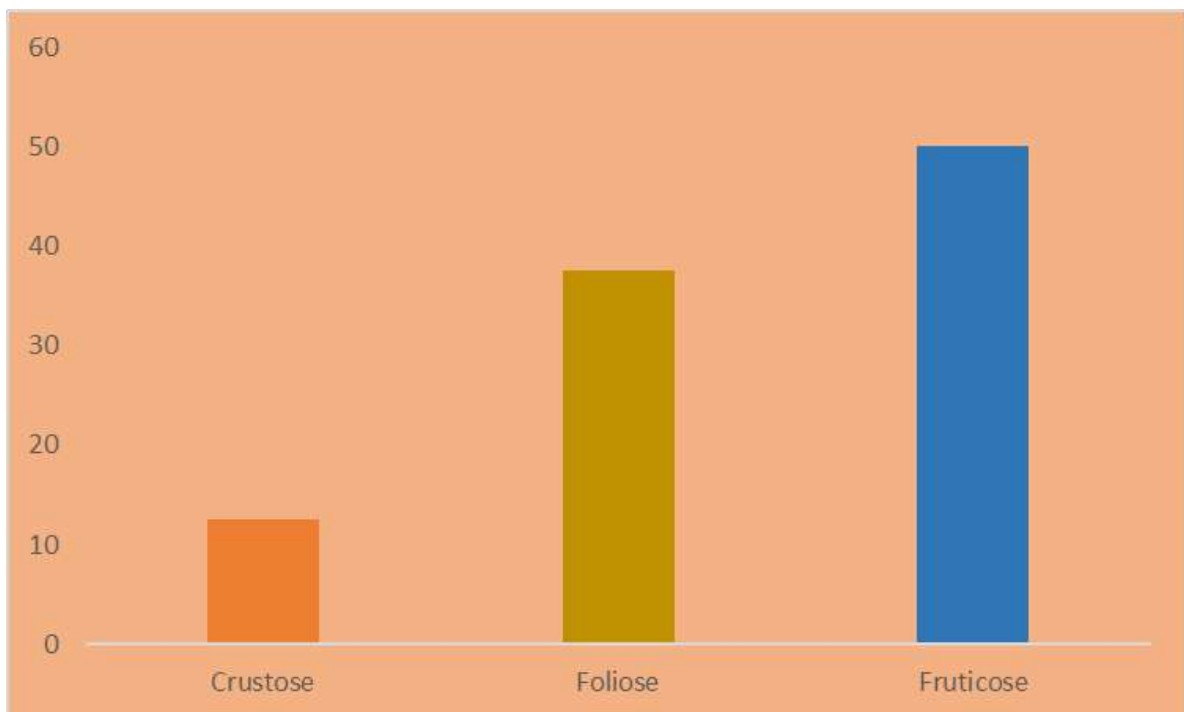
13.3.1.2. Lichen diversity in the SAWC Campus

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 results in lichens and occupied in plant kingdom. In this relationship both the organisms are mutually benefited. The algal partner may be cyanobacteria or the blue green algae and this is responsible for the process of photosynthesis. The algae thus provide food or nutrition for the fungi too. The fungal partner in turn provides space and protection for the algae. The lichen is an autotrophic organism in the sense that they can produce their own food by the process of photosynthesis. Even though the lichen is made up of two different organisms, the characteristics of the lichen are entirely different from the original characteristics of the algal and the fungal partner. Lichens are classified as micro lichens and macro lichens in which the microlichens cover the substrate on which they grow in the form of a crust whereas macro lichens grow in the form of a bush or a leaf like structure. The major forms of lichens are a) Foliose lichens exhibit a flat leaf like thallus, b) Fruticose lichens exhibit erect, pendulous and bushy thallus c) Squamulose lichens exhibit thallus with minute, scale like squamules and d) Crustose lichens exhibit flat crust shaped thallus.

Lichen diversity recorded in the SAWC Campus showed a total of 8 different lichens species representing 7 genera and 5 families. Four species of Fruticose growthforms which includes *Usnea subfloridana*, *Usnea stigmatoides*, *Ramalina fastigiata* and *Ramalina farinacea* were accounted for 50% of total available lichen diversity and identified up to species level. Three species of Foliose growth forms which includes *Physcia adscendens*, *Xanthoria parietina* and *Cercopitheciidae* accounted for 37.5 % and one species of Crustose growth form *Arthonia recedens* accounted for remaining 12.5 % of the total lichen diversity observed.



Species Diversity of SAWC Campus



Growth form Diversity in the SAWC Campus

Table 6. Lichen diversity of the SAWC Campus with respect to family, substratum and growth forms in genus and family wise classification

| S.No | Lichen diversity of the SAWC Campus | Family | Growth forms |
|------|-------------------------------------|-----------------|--------------|
| 1. | <i>Arthonia recedens</i> | Arthoniaceae | Crustose |
| 2. | <i>Cercopitheciidae</i> | Parmeliaceae | Foliose |
| 3. | <i>Physcia adscendens</i> | Physciaceae | Foliose |
| 4. | <i>Ramalina farinacea</i> | Ramalinaceae | Fruticose |
| 5. | <i>Ramalina fastigiata</i> | Ramalinaceae | Fruticose |
| 6. | <i>Usnea stigmatoides</i> | Parmeliaceae | Fruticose |
| 7. | <i>Usnea subfloridana</i> | Parmeliaceae | Fruticose |
| 8. | <i>Xanthoria parietina</i> | Teloschistaceae | Foliose |

13.3.3. Algal diversity in the SAWC Campus

Chlamydomonas, *Scytonema*, *Oscillatoria*, *Oedogonium*, *Spirogyra*, *Volvox*, *Microcystis* and *Cladophora spp.* belonging to the class of Cyanophyceae, Chlorophyceae and Bacillariophyceae are the predominant species found in the campus. The families Chlorellaceae, Closteriaceae, Desmidiaceae, Radiococcaceae, Ulotrichaceae, Uronemataceae and Oedogoniaceae were represented by single genus and species. Chlorophyceae plays an important role in both terrestrial and aquatic ecosystem as most of the members are found to be ecologically important. The highest diversity of Chlorophyceae indicated relatively good health of atmosphere. The presence of these algal species in abundance can be concluded that the SAWC Campus ecosystem has high amount of organic nutrients in soil and rock. Generally, occurrence of abundant algal flora at a place indicates the availability of abundant nutrients along with conducive favourable environmental conditions.

13.3.1.3. Mushrooms diversity in the SAWC 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 high temperature in Thiruchirappalli the climate is found to be unfavourable for the growth of Mushrooms. Mushroom growth 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.

13.3.2. Fauna Diversity in the SAWC Campus

13.3.2.1. Birds Diversity in the SAWC Campus

The observations on fauna diversity indicated that the SAWC Campus has a large number of living as well as visiting animals, birds, reptiles and insects including termites. A total number of 21 birds belonging to the 9 species were recorded from different habitats during the observation. Totally 21 species of birds representing 10 genera under 8 families were observed during this study. Passeriformes and Galliformes constituted the predominated group representing 2 species each. The other order including Anseriformes, Columbiformes, Pelecaniformes, Cuculiformes and Charadriiformes constituted with one species each. Total number of visiting birds were found to be Coppersmith Barbet, Black-winged stilt and Pied Bushchat. They migrate during winter and summer season in search of favourable environment and availability of food resources.



Table 7. Birds Diversity in the SAWC Campus

| S.No | Common Name | Scientific Name |
|------|--------------------|------------------------------|
| 1. | Common Myna | <i>Acridotheres tristis</i> |
| 2. | Barrow's Goldeneye | <i>Bucephala islandica</i> |
| 3. | Roch Pigeon | <i>Columba livia</i> |
| 4. | House Crow | <i>Corvus splendens</i> |
| 5. | Little Erget | <i>Egretta garzetta</i> |
| 6. | Asian Koel | <i>Eudynamys scolopaceus</i> |
| 7. | Chicken | <i>Gallus domesticus</i> |
| 8. | Black-winged stilt | <i>Himantopus himantopus</i> |
| 9. | Wild Turkey | <i>Meleagris gallopavo</i> |

Table 8. Total number of visiting birds in the SAWC Campus

| S.No | Common Name | Scientific Name |
|------|--------------------|---------------------------------|
| 1. | Black-winged stilt | <i>Himantopus himantopus</i> |
| 2. | Coppersmith Barbet | <i>Psilopogon haemacephalus</i> |
| 3. | Pied Bushchat | <i>Saxicola caprata</i> |

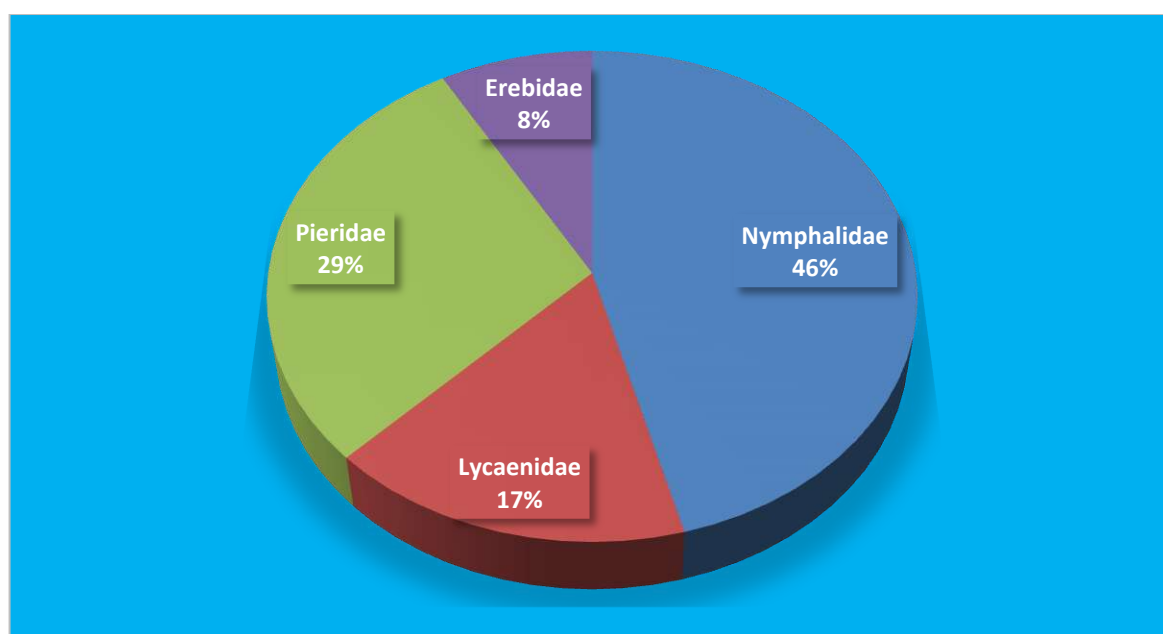
13.3.2.2. Butterflies diversity in the SAWC Campus

The SAWC campus was found to have 48 species of Butterflies under four family level diversities such as Pieridae, Nymphalidae, Lycaenidae and Erebidae in

which Common Sailer, Plain Tiger Butterfly, Lesser Grass Blue, Indian Wanderer, Forget-me-not, Common Crow Butterfly, Dot-underwing Moth, Common Grass Yellow, Yellow orange Tip, Lemon Pansy, Chocolate Pansy, Plain Orange-Tip and Dark Blue Tiger Butterfly are commonly found.

Table 9. List of Butterflies recorded in the SAWC Campus

| S.No. | Common Name | Scientific Name | Family |
|-------|-----------------------|----------------------------|-------------|
| 1. | Common Sailer | <i>Neptis hylas</i> | Nymphalidae |
| 2. | Plain Tiger Butterfly | <i>Danaus chrysippus</i> | Nymphalidae |
| 3. | Lesser Grass Blue | <i>Zizina otis</i> | Lycaenidae |
| 4. | Indian Wanderer | <i>Pareronia hippia</i> | Pieridae |
| 5. | Forget-me-not | <i>Catochrysops strabo</i> | Lycaenidae |
| 6. | Common Crow Butterfly | <i>Euploea core</i> | Nymphalidae |
| 7. | Dot-underwing Moth | <i>Eudocima materna</i> | Erebidae |
| 8. | Common Grass Yellow | <i>Eurema hecabe</i> | Pieridae |
| 9. | Yellow orange Tip | <i>Ixias pyrene</i> | Pieridae |
| 10. | Lemon Pansy | <i>Junonia lemonias</i> | Nymphalidae |
| 11. | Chocolate Pansy | <i>Junonia iphita</i> | Nymphalidae |
| 12. | Plain Orange-Tip | <i>Colotis aurora</i> | Pieridae |



Butterfly Diversity in the SAWC Campus

13.3.2.3. Mammals diversity in the SAWC 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 SAWC campus indicated that around 34 Mammal species are commonly distributed. The commonly found mammals are Domestic cow, Dog, Goat, Cats, Three -stripped Palm Squirrel, Schneider's Roundleaf Bat, Bonnet Macaque, Common Indian Field Mouse Indian Grey Mongoose.

Table 10. List of Mammals diversity in the SAWC campus

| S.No. | Common Name | Scientific Name |
|-------|-------------------------------|-----------------------------|
| 1. | Domestic cow | <i>Bos taurus</i> |
| 2. | Dog | <i>Canis familiaris</i> |
| 3. | Goat | <i>Capra hircus</i> |
| 4. | Cats | <i>Felis catus</i> |
| 5. | Three -stripped Palm Squirrel | <i>Funambulus palmarum</i> |
| 6. | Schneider's Roundleaf Bat | <i>Hipposideros speoris</i> |
| 7. | Bonnet Macaque | <i>Macaca radiata</i> |
| 8. | Common Indian Field Mouse | <i>Mus booduga</i> |
| 9. | Indian Grey Mongoose | <i>Urva edwardsii</i> |

13.3.2.4. Amphibians diversity in the SAWC 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 MAM indicated that around 7 species are Amphibians are commonly distributed. The commonly found amphibians are listed.

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 90% are frogs. Observation made in the SAWC Campus on diversity of Amphibians revealed that around 11 species of Amphibians are commonly disseminated. The commonly found amphibians are *Uperodon taprobanicus* (Sri Lankan Bullfrog) and *Euphylyctis cyanophlyctis* (Common Skittering frog).

13.3.2.5. Grasshopper diversity in the SAWC 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 SAWC campus on diversity of Grasshoppers demonstrated that 6 species of Grasshoppers are commonly distributed which includes *Eyrepocnemis alacris*, *Cyrtacanthacris tartarica*, *Crucinotacris decisa*, *Aulacobothrus luteipes*, *Acrotylus humbertianus* and *Sathrophyllia rugosa*.

13.3.2.6. Termites Diversity in the SAWC 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. Three species of Termites (*Odontotermes anamallensis*, *Trivitermes fletcheri* and *Nasutitermes indicola*) recorded during on-site Green Campus audit at SAWC campus 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 SAWC 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) and Gerbera Daisy (*Gerbera jamesonii*) plants are unique for oxygen release during night time and they are able to purify the atmospheric air in terms of removal of toxic gases. Although options are available to enhance the level of oxygen by reducing CO₂ with the aid of oxygenators and air purifiers, there are certain alternatives to improve the air quality which is beneficial for both body and mind. Green campus audit at SAWC campus revealed that the campus is surrounded by *Azadirachta indica* (Neem), *Terminalia catappa* and *Ficus religiosa* are found to be oxygen releasing plant. *Hibiscus rosa-sinensis*, *Aloe vera* and *Tabernaemontana divaricate* are CO₂ assimilating plants found in the campus.

Table 12. List of Oxygen releasing and Carbon dioxide assimilating, Ornamental / Medicinal plants in the SAWC campus

| S.No | Plant Name (English) | Scientific Name | Grouping / Nature | Characteristic Features of the plant |
|------|--------------------------------|-----------------------------------|-------------------|---|
| 1. | Neem | <i>Azadirachta indica</i> | Dicots | O ₂ releasing Plant |
| 2. | Almond | <i>Terminalia catappa</i> | Dicots | O ₂ releasing Plant |
| 3. | Areca palm | <i>Dyopsis lutescens</i> | Monocot | O ₂ releasing Plant |
| 4. | Money plant | <i>Epipremnum aureum</i> | Monocot | O ₂ releasing Plant |
| 5. | Weeping fig | <i>Ficus benjamina</i> | Dicot | O ₂ releasing Plant |
| 6. | Chinese hibiscus/Shoe Flower | <i>Hibiscus rosa-sinensis</i> | Dicots | CO ₂ assimilating Plant / Ornamental Plant |
| 7. | Coconut tree | <i>Cocos nucifera</i> | Dicots | Ornamental Plant / Nut yielding Plant |
| 8. | Aloe vera | <i>Aloe vera</i> | Monocots | CO ₂ assimilating Plant / Medicinal Plant |
| 9. | Crape Jasmine/ Pinwheel Flower | <i>Tabernaemontana divaricata</i> | Dicots | CO ₂ assimilating Plant / Ornamental Plant |

13.5. Lawns, Trees, Herbs, Shrubs, Climbers and Lianas in the SAWC campus

Lawns are gazing features of unutilized land made to cover the soil with green grass for the ambience of the place to have a greenish look. Lawn provides a hollow space among the building structures. The shaded trees in between the grass lawn, pathways and garden benches are meaningful lineaments to the green campus. The advantage of lawn is that it prevents the unintended weeds growth in the unutilized landscape areas. Trees that are native to land with medicinal value, ethnicity and environmental value add an advantage to green building. Purpose of trees is to provide shade, atmospheric CO₂ sequestration and supply of oxygen that serves the purpose of a green campus. Herbs are small plants with medicinal values and shrubs are small plants with thick stems and can hold soil to some extent than the herbs and serve the purpose of soil erosion. Climbers can grow with the support of wall structures and the climbers can enhance the wall value with greeneries.

The SAWC campus were found to have sufficient number of trees, herbal plants, bushes, climbers 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 SAWC campus are *Rhinacanthus nasutus*, *Tabernaemontana divaricate*, *Calotropis gigantea*, *Ixora coccinea*, *Ixora chinensis*, *Euphorbia milii*, *Alternanthera Loropetalum*, *Ficus stenophylla*, *Furcraea foetida*, *Aloe barbadensis* and *Hibiscus rosa sinensis*.

Similar to that of shrubs, the predominant species of herbs available in the SAWC campus are *Ruellia tuberosa*, *Plectranthus hadiensis*, *Solanum americanum*, *Phyllanthus niruri*, *Sporobolus indicus* and *Tridax procumbens*.

The existence of climbers *Dregea volubilis* and *Syngonium angustatum* whose stems are weak, which needs support to grow, where it climb up trees and walls and grow vigorously without any pest and disease attach which are observed in the SAWC campus.

13.6. Establishment of different Gardens in the SAWC campus

Growing many types of herbal plants having medicinal importance in the campus becomes more attractive and useful if concept gardens are maintained. Medicinal plant gardens can contain the locally available medicinal plants, RET (Rare Endangered Threatened) listed plants and those plants are most useful in terms of economic importance. The tree garden / arborea can be planted based on the zodiac signs which would attract the public and students, faculties, staff members, employees and educate them based on their uses. In the tree gardens, trees as linings all over the campus can act as oxygen corridors. Native trees along with trees like *Azadirachta*, *Pongamia* and *Ficus* species can be cultivated at the maximum as these plants are used to remove the dust particles and carbon lead from the air and purifies the air considerably. Similarly, the ornamental plants with beautiful flowers can be maintained in the frontage gardens of campus for attraction and good ambience. This will give an overall aesthetic look and also provide fresh air for healthy respiration to the stakeholders.

In SAWC 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 of unusual features also planted to be of interest, such as the prominent thorns of cactus and snake cactus. There are 6 varieties of ornamentals plants we are maintaining surrounding of our college campus. These plants are making the college campus pleasantly and decoratively. Every year they try to plant new varieties with help of Environmental department. Once in three months the unwanted barks of the plants are cut it down, to make the beautification of their campus. No plant is cut unless it becomes dead. Not only can visitors enjoy seeing the ornamentals plants and also humming birds, butterflies shelter in that. This environment makes campus greenish and pleasant.

13.7. Natural Topography and Vegetation

Natural topography means the original geographical features of the campus, around 25- 30% of the organization should have the natural features like rocks, water resources, slopes, landscape, pathways, etc. and the altered topography can be accounted for, it is facilitated. The vegetation in the land alone is considered as they are part of the natural topography. The vegetation in the artificially created structures are also accounted for when it is reported more than 25% of the claimed green campus audit site. Vegetation is the cultivation of a bunch of plants irrespective of the plant *taxa* for the covering of the area or ground topography. Natural topography is better appreciated with wild vegetation than the artificially created topography like pathways and parking areas. The observation at the SAWC campus indicated that more than 25% natural topography and vegetation have been maintained properly. Further, there was no anthropogenic activity in some of the interior side of the campus.

13.8. Rainwater Harvesting System and Percolation Pond

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

13.9. Landscape design and Soil Erosion control

Landscape management is the 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 SAWC 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 SAWC 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 SAWC campus is free of exotic plants that cause threat to the natural vegetation. 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 SAWC 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 SAWC 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 SAWC campus to cultivate plants. Agrochemicals, chemical fertilizers (urea, murate of potash, sulphate of potash, rock phosphate, etc.), pesticides and fungicides are not used. These practices are very well appreciated because air, water and soil pollution due to use of agrochemicals is eradicated which in turn to improve the soil health significantly.

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

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

conferences, workshops, awareness rallies, etc. on topics relevant to the environment is necessary to educate and create awareness among the students and staff members. In addition, student's associations, cells, clubs and forums should be the first hand receivers of all the new plans proposed by the Government such as Swachh Bharath Abhiyan and Jal Shakti Abhiyan under Clean India Mission and implement the same in the campus.



The SAWC campus 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 SAWC campus facilitates to prepare the students for future life, by developing qualities such as cooperation, team spirit, leadership, discipline and development of creative talents including to boost the self-confidence of students.

13.15. Establishment of Aquarium and Aquatic plants

Growing fishes in the small ponds will keep the environment pleasant. In the closed environment like corridors and the front offices, auditoriums and gallery classes placing the fish aquarium as well as plant aquarium will improve the scenic value of the place bringing peace to the people. The fish water waste also can be used as manure for growing potted indoor plants. Growing *Lotus*, *Lilly*, *Hydrilla* and other water plants will give a pleasant and calm environment and growing fishes like *Guppies* can keep the water clean and neat. The fountains and small ponds can be built in the frontages to give an aesthetic look and also growing water plants in these ponds will help to maintain the aesthetic sense of the environment in greenish. The SAWC campus has a open Aquarium in which fishes golden fishes along with *Guppies* were also 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 SAWC campus 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 SAWC campus is maintaining more than 25% 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 55% and planted vegetation was 45%.
2. The SAWC Campus is situated at Gudiyattam, Vellore. The campus is planted with many flowering and non- flowering plants. The green vegetation is also utilized in growing farm animals. The campus is also enriched with many birds and butterflies. Thereby the campus provided the stakeholders with clean and green environment. Study/documentation of biodiversity provides a useful measure of the quality of the environment and the ecological studies are important aspects of environment, in view of the consideration of environmental quality and natural flora and fauna conservation.
3. In view of floral biodiversity in the SAWC campus, a sum 198 species belonging to 35 Genera under 27 families covering trees, herbs, shrubs, climbers, lianas, twiners and lawns and 10 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.
4. In view of faunal biodiversity in the SAWC campus, a total of 20 living Mammals, 11 species of birds, 4 species of Grasshopper, 3 species of Termites, 11 species of Amphibians, 7 species of Reptiles, 48 species of Butterflies and two species Mosquitos were recorded and documented.
5. The campus has a maximum number of more oxygen releasing and carbon dioxide assimilating plants *Azadirachta indica* (Neem), *Terminalia catappa* and *Ficus religiosa* are found to be oxygen releasing plant. *Hibiscus rosa-sinensis*, *Aloe vera* and *Tabernaemontana divaricate* are CO² assimilating plants including some of the shrub and herbal plants.
6. The SAWC campus, Departments of Electrical & Electronics Engineering, Electronics and instrumentation Engineering, Information Technology, Mechanical Engineering, Civil Engineering, Computer Science and Engineering and Agricultural Engineering are offering various courses in Regulation 2020 related to Environment Studies, Natural Disaster Management and Waste Management to the students and research scholars.

15. Recommendations for Greening

- The name board may be kept in each plant species in which the common name along with binomial name may be mentioned. The year of planting and economic importance with medicinal values if any may be mentioned in some plants so that the oldest as well as useful herbal plants may be identified in the campus.
- 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.
- 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.
- Vermicompost production may be increased substantially using tree leaf litter, kitchen wastes and biodegradable waste materials available in the campus. The vermicompost manure can be used for plant cultivation and the excess amount of vermicompost may be sold in the local market as consultation work.
- 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.
- SAWC 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.
- To ensure Miyawaki Forest system, one student one plant concern to enrich the campus Green which provide an ecofriendly campus to the stakeholders.

16. Conclusion

After the establishment of SAWC Campus, in the past three decades, 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 SAWC Campus is a well-established selfsupporting Institution in Vellore District 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 SAWC Campus is maintaining more than 25% of the green cover area after building construction along with 55% of natural vegetation and 45% planted vegetation.

The natural topography and very good landscape design without disturbing the natural vegetation are being maintained by the SAWC. 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 grown many medicinal, herbal and ornamental plants for providing an eco-friendly atmosphere to the stakeholders in a sustainable manner.

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Methodology for Flora and Fauna Identification

I. Identification of Flowering Plant Species

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

Key to Plant Families Identification

- | | |
|--|-----------------|
| 1a. Seeds enclosed in fruit wall, Perianth Present..... | 2 |
| b. Seeds not enclosed in fruit wall, perianth absent..... | Gymnosperm |
| 2a. Leaves usually net veined seeds-2..... | 3 |
| b. Leaves parallel veined, seeds-1..... | 66 |
| 3a. Petals free..... | 4 |
| b. petals connate | 41 |
| 4a. Corolla and calyx present..... | 5 |
| b. Corolla and calyx absent..... | 24 |
| 5a. calyx of united sepals; ovary inferior | 31 |
| b. Calyx of distinct or unit sepals; ovary syncarpous..... | 6 |
| 6a. Sepals imbricate in bud | 7 |
| b. Sepals valvate in bud..... | 24 |
| 7a. Sepals more or less united at the base..... | 19 |
| b. Sepals free | 8 |
| 8a. Stamens more than 12 | 9 |
| b. Stamens 10 or fewer | 13 |
| 9a. Sepals 2-3..... | 11 |
| b. Sepals 4 or more..... | 10 |
| 10a. Stamens inserted on the disk..... | Cleomaceae |
| b. Stamens inserted of the gynophore | Capparaceae |
| 11a. Trees, Petals more or like the sepals; carpels free | Magnoliaceae |
| b. Herbs, petals coloured unlike the sepals; carpels united..... | 12 |
| 12a. Plants with yellow sap, Flowers pedicelled | Papaveraceae |
| B. Plants with watery sap, Flowers sessile..... | Portulacaceae |
| 13a. Flowers unisexual, gynoecium apocarpus..... | |
| Menispermaceae | |
| b. Flowers bisexual, gynoecium Syncarpous..... | 14 |
| 14a. Petals 4, Stamens 6 | Brassicaceae |
| b. Petals 5, Stamens ∞ | 15 |
| 15a. Ovary 1, loculated | 16 |
| b. Ovary 2-more loculated..... | 17 |
| 16a. Flowers actinomorphic, placentas free- central | Caryophyllaceae |
| b. Flowers zygomorphic, placentas parietal | Viloiaceae |
| 17a. Filaments of anthers more or less united | Polygalaceae |
| b. Filaments of anthers more or less united | 18 |
| 18a. Leaves stipulate; stamens 5 or 10 | 19 |
| b. Leaves exstipulate; stamens usually 8 | Sapindaceae |

- 19a. Style 5; stamen 5 Oxalidaceae
 b. Style many; stamens 10 Zygophyllaceae
- 20a. Leaves pellucid-gland dotted Rutaceae
 b. Leaves not gland dotted21
- 21a. Placentas parietal; Fruit elongatedMoringaceae
 b. Placentas axile; Fruits not elongated22
- 22a. Ovules and seeds pendulous; sometimes horizontal.....Meliaceae
 b. Ovules and seeds erect or ascending23
- 23a. Stamens alternate with the petals..... Anacardiaceae
 b. Stamens opposite the petalsVitaceae
- 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 ring28
- 26a. Stamens 15; anther unitedStericuliaceae
 b. Stamens 2; anther free.....27
- 27a. Anther unilocular; pollen muricateMalvaceae
 b. Anther bilocular; pollen smoothBombacaceae
- 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 petals30
- 29a. ShrubLythraceae
 b. StragglerRhamnaceae
- 30a. Anther dehisce by slits; fruits capsuleTiliaceae
 b. Anther dehisce by spores; fruits drupeElaeocarpaceae
- 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 freeCaesalpinaceae
- 37a. Flowers unisexual.....Cucurbitaceae
 b. Flowers bisexual.....38
- 38a. Ovary 1-celled.....Cactaceae
 b. Ovary more than 1 celled.....39
- 39a. Carpels free if ultimately united the styles distinct.....40
 b. Carpels and styles united throughout.....Myrtaceae
- 40a. Flowers in dichasial – polychasial cyme.....Molluginaceae
 b. Flowers in clustered, cymes or solitary.....Aizoaceae
- 41a. Ovary inferior, stamens as many as the corolla lobes.....42
 b. Ovary superior, stamens numerous.....43
- 42a. Anther free; ovary 2-loculed; stipulate.....Rubiaceae

- b. Anther syngenesious; ovary 1-loculed, exstipulate.....Asteraceae
- 43a. Ovary 1-loculed; placentation free central.....Plumbaginaceae
 - b. Ovary 2-many loculed; placentation axile or parietal.....44
- 44a. Ovary 3 or more carpelled.....Sapotaceae
 - b. Ovary 2-carpelled.....45
- 45a. Corolla actinomorphic.....46
 - b. Corolla zygomorphic.....50
- 46a. Plants leafless; parasitic.....Cuscutaceae
 - b. Plants leafy ; not parasitic47
- 47a. Leaves opposite; stamens 2.....48
 - b. Leaves alternate; stamens 4 or more49
- 48a. Leaves not scabrid, corolla tube white: fruits berryOleaceae
 - b. Leaves scabrid; corolla tube orange; fruits capsulesNyctanthaceae
- 49.a. Anther inseperatable; corona presentAsclepidiaceae
 - b. Anther seperatable; corona absentApocyanaceae
- 50a. Corolla lobes imbricate ;fruit drupeBoraginaceae
 - b. Corolla lobes plicate; fruit capsuleConvolvulaceae
- 51.a Ovary cells many ovulatedSolanaceae
 - b. Ovary cells 1-4 ovuled.....52
- 52.a Carpels 2 or more ovulated ; fruits dehiscent53
 - b. Carpels 1 –ovulated ; fruits indehiscent57
- 53.a Fruits dehiscent; seeds supported on reticulae.....Acanthaceae
 - b. Fruits indehiscent; seeds not supported on reticulae.....54
- 54.a. Leaves compound; fruits elongated; seeds wingedBignoniaceae
 - b. Leaves simple;fruits not elongated, seeds not winged.....55
- 55.a. Ovules many on swollen placentas; seeds albuminous.....Scropulariaceae
 - b. Ovules 2 lobed placenta ; seeds not albuminous.....56
- 56.a Flowers solitary; axile placentationPedaliaceae
 - b. Flowers raceme; axile placentation.....Martyiniaceae
- 57.a Ovary entire, style terminalVerbinaceae
 - b. Ovary 4 –lobed, style gynobasic.....Lamiaceae
- 58.a Flower bisexual59
 - b. Flower unisexual62
- 59.a. Ovary inferior60
 - b. Ovary superior61
- 60.a Ovary 4-6 loculated; ovules manyAristolochiaceae
 - b. Ovary 1-loculated; ovules 1-4Santalaceae
- 61.a Perianth not tubularAmarathaceae
 - b. Perianth trubularNyctaginaceae
- 62a. Leafless trees; brachlets ribbed and joined at the nodes.....Casuarinaceae
 - b. Leaves well developed ; brachlets not ribbed and not joined at the nodes.....63
- 63 a. Ovary 1- loculed; ovules 1-2 in each loule.....64
 - b. Ovary 2 or more loculed;ovules 1 or 2 in each locule.....65
- 64a. Leaves glandular.....Euphorbiaceae
 - b. Leaves eglandular.....Urticaceae
- 65a. Filaments inflexed in bud with reversed anther.....Moraceae
 - b. Filaments not inflexed in bud, not with reversed anther.....Ulmaceae

| | |
|---|----------------|
| 66a. Terrestrial or epiphytic..... | 67 |
| b. Aquatic, marsh or riparian..... | Cyperaceae |
| 67a. Arbrorescent woody; leaf blade many nerved articulate with sheath..... | Bambusaceae |
| b. Herbs with herbaceous culms; leaf blade sessile not articulate with sheath.... | 68 |
| 68a. Perianth 0 or reduced to scale..... | Araceae |
| b. Perianth present..... | 69 |
| 70a. Plant armed..... | 71 |
| b. Plant unarmed..... | 72 |
| 71a. Plants Xerophytic; leaves fibrous..... | Agavaceae |
| b. Plants not xerophytic; leaves nor fibrous..... | Lilliaceae |
| 72 a. Perianth segments connate..... | Amaryllidaceae |
| b. Perianth segments free..... | 73 |
| 73a. Outer perianth calycine; inner coroline..... | Commelinaceae |
| b. Outer and inner perianth..... | 74 |

II. Identification of Non-Flowering Plant Species

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

Key to identify the Lichen Genera

Key to Genera

| | |
|--|-------------------------------|
| 1 a. Photobiont cyanobacteri urn | <i>Leptogium cyanascens</i> . |
| 1 b. Photobiont green alga | 2 |
| 2. Thallus leprose, crustose..... | Group I |
| 3. Thallus foliose..... | Group II |
| 4. Thallus fruticose..... | Group III |

Group I

| | |
|----------------------------|-----------------------------|
| 1 a. Thallus leprose,..... | <i>Chrysothrix chlorina</i> |
| 1 b. Thallus crustose..... | <i>Graphis</i> sp |

Group II

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

| | |
|---|-----------------------------|
| 7 a. Lobe margins ciliate..... | 8 |
| 7 b. Lobe margins eciliate..... | 9 |
| 8 a. Salazinic acid present K ⁺ Red cortex..... | 10 |
| 8 b. Salazinic acid absent | 11 |
| 9 a. Thallus with isidia..... | <i>Parmotrema tinctorum</i> |
| 9 b 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*

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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*
398. 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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LIG II, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641004, TAMILNADU, INDIA.

has been assessed and found to conform to the requirements of

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for the following scope :

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| SOCIAL CATEGORY OF ENTREPRENEUR | | GENERAL | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NAME OF UNIT(S) | | <table border="1"> <thead> <tr> <th>S.No.</th> <th colspan="3">Name of Unit(s)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td colspan="3">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 colspan="2">GANDHIMAA NAGAR</th> </tr> </thead> <tbody> <tr> <td>Village/Town</td> <td>Gandhimsanagar S.O</td> <td>Block</td> <td colspan="2">LIG-II</td> </tr> <tr> <td>Road/Street/Lane</td> <td>Peelamedu</td> <td>City</td> <td colspan="2">Coimbatore South</td> </tr> <tr> <td>State</td> <td>TAMIL NADU</td> <td>District</td> <td colspan="2">COIMBATORE , Pin 641004</td> </tr> <tr> <td>Mobile</td> <td>9566777255</td> <td>Email:</td> <td colspan="2">chairmansmf@gmail.com</td> </tr> </tbody> </table> | | | | Flat/Door/Block No. | LIG-IL2669 | Name of Premises/ Building | GANDHIMAA NAGAR | | Village/Town | Gandhimsanagar S.O | Block | LIG-II | | Road/Street/Lane | Peelamedu | City | Coimbatore South | | State | TAMIL NADU | District | COIMBATORE , Pin 641004 | | Mobile | 9566777255 | Email: | chairmansmf@gmail.com | |
| Flat/Door/Block No. | LIG-IL2669 | Name of Premises/ Building | GANDHIMAA NAGAR | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Mobile | 9566777255 | Email: | chairmansmf@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 provision of Notification No. S.O. 2119(E) dated 26.06.2020 issued by the Min MSME.

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For any assistance, you may contact:

1. District Industries Centre: COIMBATORE (TAMIL NADU)

2. MSME-DI: CHENNAI (TAMIL NADU)

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The screenshot shows the top section of the NGO DARPAN website. At the top left, there are logos for the Government of India, NGO, and DARPAN. To the 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" link is on the right. The main banner features a photo of a group of people and the text "NGO DARPAN" and "In order to strengthen services of the portal, Government has decided to make PAN Number of VOs/NGOs mandatory." Below the banner, there are three horizontal bars: a light blue one saying "Please Update Your Profile", a teal one saying "Welcome, Nature Science Foundation", and a light blue one displaying "Your Unique Id: TN/2018/0187711".

NGO DARPAN

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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, Gandhimaa 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 FAN AACTN7857J was constituted by ~~Trust Deed / Memorandum of Association~~ dated 29/11/2017 registered with ~~Sub-Registrar's Office/ Registrar of Societies/Registrar of Companies/others~~ on 29/11/2017.
 2. ~~The Trust Deed / Memorandum of Association has subsequently been amended / modified / altered by a Codicil / Supplementary Deed / Amendment Deed / Alteration to Memorandum of Association/others dated XX/XX duly registered on XX/XX.~~
 3. The above TRUST filed an application seeking Registration u/s 12 AA of the Income tax Act, 1961.
 4. On going through the objects of the TRUST and its proposed activities as enumerated in the ~~Trust Deed / Memorandum of Association~~, I am satisfied about the genuineness of the TRUST as on date.
 5. The application has been entered at Sl.No.1105 maintained in this office. The above Trust is accordingly registered as a PUBLIC CHARITABLE TRUST u/s 12 AA of the Income Tax Act, 1961 with effect from 29/11/2017.
 6. It is hereby clarified that the Registration so given to the Trust/Institution is not absolute. Subsequently, if it is found that the activities of the Trust/Institution are not genuine or are not being carried out in accordance with the objects and clauses of the ~~Trust Deed / Memorandum of Association~~ submitted at the time of registration or modified with the approval of the Commissioner of Income-tax (Exemptions), Chennai or there is a violation of the provisions of Section – 13, the Registration so granted shall be cancelled as provided u/s 12 AA (3) or 12AA(4) of the Income Tax Act. Further, this approval is also subject to the ~~Trust/Society/Association/Company/ Others/~~ complying to the provisions of the proviso to sec 2(15) of the Income Tax Act 1961.
 7. Granting of Registration u/s 12AA does not confer any automatic exemption of income from taxation. The Trust/Institution should conform to the parameters laid down in Sections '11, 12, 13 and 115 BBC of the I.T. Act, 1961, to claim exemption of its income on year to year basis before the Assessing Officer.
- ** This Unique Registration No. URNo. AACTN7857J/05/18-19/T-1105 Should be mentioned in all your future correspondence.



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

Copy to:

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

//CERTIFIED TRUE COPY//

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



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

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

Date: 10.04.2019

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

Received
Rajiv S. Ramesh
17/07/19
17/07/2019

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

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

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



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

Copy to:

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

//Certified True Copy//

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

Certificates of Green Campus Auditors

1. ISO Environment Management System (14001:2015 TUV NORD) of Dr. A. Geethakarathi, NSF Environment Auditor.
2. Indian Green Building Council (IGBC AP) Accredited Professional of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
3. Associated Chambers of Commerce and Industry of India (ASSOCHAM), of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
4. Associated Chambers of Commerce and Industry of India (ASSOCHAM), of Er. Ashutosh Kumar Srivastava, Board of Directors (North Zone) 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.



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

Certificate of Achievement

Geethakarathi Alagarsamy

has successfully completed the above mentioned course and examination.

23rd - 27th March 2019

COIMBATORE, INDIA

Certificate No. 35242817 02

Delegate No. 171136

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

for TÜV NORD CERT GmbH

Essen, 2019-04-26

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

TÜV NORD CERT GmbH

Langemarckstraße 20


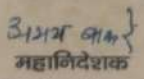
45141 Essen

www.tuev-nord-cert.com





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|--|--|----------------------|
| Regn. No. EA-7391 |  NATIONAL Productivity Council | Certificate No. 5093 |
| National Productivity Council (National Certifying Agency) | | |
| <u>PROVISIONAL CERTIFICATE</u> | | |
| This is to certify that Mr. / Ms. <u>N. Balasubramaniam</u> son / daughter of Mr. <u>M. Nanjukuttigounder</u> has passed the National Certification Examination for Energy Auditors held in December - 2009, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India. | | |
| 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 |  Controller of Examination | |
| Date : 11 th February 2010 | | |

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|  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 <u>दिनेश कुमार</u> ने ऊर्जा संरक्षण भवन निर्माण संहिता के लिए <u>7 दिसंबर '16</u> से <u>8 दिसंबर '16</u> तक एम्पनआईटी / सीईपीटी / आईआईआईटी द्वारा आयोजित मास्टर ट्रेनर सर्टिफिकेट कार्यक्रम को सफलता पूर्वक सम्पन्न कर लिया है। This is to certify that Shri/Smt. <u>Dinesh Kumar</u> has successfully completed the Master Trainer Certificate Programme conducted by MNIT / GEPT / IIIT from <u>7 December '16</u> to <u>8 December '16</u> for the Energy Conservation Building Code. | |
| नई दिल्ली, <u>07 JUL 2017</u> New Delhi, _____ |  महानिदेशक Director General |