



NSS COLLEGE, NEMMARA

PALAKKAD 678 508, KERALA

GREEN AUDIT REPORT 2022 - '23



Nature's Green Guardians Foundation
Trivandrum 695043



NSS College, Nemmara, Palakkad

Green Audit Report 2022-23

Contents

NSS College Nemmara – Profile	5
Vision and Mission	7
At a Glance	9
Executive Summary	11
Campus Green Protocol	13
Green Audit 2022-23: Procedures and Priorities	15
Campus Population; Programmes during 2022-23	17
1 Audit on Green Campus Initiatives	19
1.1 Campus Trespass Restrictions	19
1.2 Use of Bicycles and EVs	20
1.3 Pedestrian friendly pathways	20
1.4 Plastic Free Campus	21
2 Audit on Green Cover, Energy, and Environment	22
2.1 Green Cover (Biodiversity) Audit	22
2.2 Energy Audit	55
2.2.1 Energy Efficiency Improvement	57
2.2.2 Renewable Energy Use Audit	59
2.3. Water Audit	60
2.4. CGH – Clean, Green and Healthy – Audit	63
2.4.1 Waste Audit	63
2.4.2 Transportation Audit	66
2.4.3 Health Audit	69
2.4.4 Audit on Societal Commitment, Outreach, and Greening	69
3. Audit on Accessibility and Gender Justice	70
4. Carbon Footprint	71
Carbon Footprint Assessment	77
CF Analysis	78
5. Future Directions	79
SWOT Analysis	80
<i>Audit Certificates</i>	
6.1. <i>Green Audit (Biodiversity) Compliance Statement</i>	
6.2. <i>Green Audit (Biodiversity) Certificate</i>	
7.1. <i>Energy Audit Compliance Statement</i>	
7.2. <i>Energy Audit Certificate</i>	
8.1. <i>Environment Audit Compliance Statement</i>	
8.2. <i>Environment Audit Certificate</i>	





NSS COLLEGE, NEMMARA

Profile

NSS College, Nemmara, in Palakkad district is a college of higher education, situated 21 km in the vicinity of the picturesque hills of Nelliampathy on the western ghats. From Palakkad, the College can be reached in 46 minutes by bus along Kuzhalmannam – Alathur route. It was founded by Padmabhushan Mannath Padmanabhan, the founder of Nair Service Society (NSS) on 28 February 1966. The college, affiliated to the University of Calicut started as a Junior college in 1967 with four batches of Pre Degree, and 80 students.

Upgraded to a Senior College in the year 1971-72, it offered under graduate courses of Commerce, History, Chemistry, and Mathematics. With the introduction of shift system in 1979-80, the number of pre degree batches rose from four to six. B Sc Physics commenced in the same year. As the college strode along, more under graduate and post graduate courses were added: BA Economics in 1980-81, M Sc mathematics, and B Sc Botany in 1981-82, B Sc Zoology in 1982-83, M Com in 1984-85, B A English in 1994-95, BBA in 1997-98, B Sc Instrumentation in 1998-99, M Sc Chemistry in 2013-14, and BA Malayalam in 2014-15. Now the college offers a total of 12 under graduate courses and three post graduate courses.

The College has a campus of 38 acres of land area (150,000 m²).





Vision and Mission

NSS COLLEGE, NEMMARA

OUR MISSION



Empowerment Through Uncompromising
Quality Education

OUR VISION

Enfranchisement
Through Heuristic
Interaction



OUR MOTTO

Thamaso mā
Jyothir
Gamaya



OUR OBJECTIVES



Academic Advancement Leading To
National Development



At a Glance

I: General

1: General Particulars

I.

Name of Educational Institution	:	N S S College, Nemmara
1 Address	:	Nemmara, Palakkad. Pin: 678508
2 Name of Local Body (Panchayat/Municipality/Corporation)	:	Melarcode Grama Panchayath
3 District	:	Palakkad
4 Name and Designation of the Principal	:	1. Dr. T Sreekumar (20.08.2022 to 19.02.2023) 2. Smt. Thulasi K A (20.08.2023 - continuing)
5 Phone number	:	04923-244265
E-mail ID	:	nsscollegenemmara@gmail.com
Name and Designation of the Contact (Teacher)	:	Dr. Sreedevi N Kutty
Phone number	:	+919446230129
E-mail ID	:	sreedevisd@gmail.com
No of students selected for conducting the Survey and Data Collection (Green Guardians)	:	40

I.

2: Basic Data

Current Academic Year		2022-23	Current Population
Total number of students in the College during the Current Academic Year (M+F)	:	354+ 969+16= 1339	
Total number of Teachers in the EI during the Current Academic Year (M+F)	:	15 + 60= 75	
Total number of other Staff in the EI during the Current Academic Year (M+F)	:	7+12 =19	Total 1,433

I.3: Divyang-jan Particulars

Number of differently-able (<i>Divyang-jan</i>) students, teachers, and other staff during the Current Year (M+F)	:	8
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I.4: Details of Land and Buildings

Building/Block Name	Utility	Plinth Area (Sq. m.)	No. of Floors	Roof: Concrete Flat/Sloppy, Tiled/Sheet
Main Building	Teaching, Office, Lab	21,000	2	Concrete
Instrumentation	Teaching, Library, Lab	14,000	2	Concrete
Canteen	Canteen, Classroom	1800	1	Concrete
Bathroom	Bathrooms	350	1	Sheet
1. Total Area of the Campus	(ha)	:	38 Acres	
2. Area of Playground	(ha)	:	5 Acres	
3. Area under open air Auditorium	(ha)	:	0.5 Acre	
4. Area on Agriculture/Gardening	(ha)	:	0.5 Acre	
5. Barren Area	(ha)	:	Nil	
6. Area: Other purposes (specify).	(ha)	:	Nil	
7. Area under Tree cover	(ha)	:	10 Acres	



Executive Summary

This Green Audit Report of the campus of N S S College, Nemmara, Palakkad district, PIN 678 508, Kerala, is prepared in a lucid form that will help even a first-year student to comprehend the ecological and ethical values of learning at this institution, as well as to get reminded on how each student can contribute to the greening initiatives of the College community. The details on the various aspects of life and learning in NSS College covered by this report will go a long way towards our Nation moving fast to achieve carbon neutrality. In India, Green learning is a right, and at the same time, a responsibility.

Observations and recommendations of the multidisciplinary green audit team on the overall green status of this higher education institution, is in effect an evaluation of the measure of commitment of the campus community to indulge only in sustainable practices. The educated youth should understand that, many of the natural calamities that the public are facing, are manmade, as well as avoidable. The ability of our people to cope with the impacts of climate change (climate resiliency) has to be built up in stages. In other words, a change of lifestyle is inevitable for everybody. However, that can only be achieved if all the educational institutions assume their crucial role, and direct the youthful energy under their command pointedly towards greening for a better future.

The findings of the Green Audit are only indicators on where and why additional efforts are required, and not in any way a criticism or commendation on its present performance. The College, affiliated to the University of Calicut is aspiring for accreditation by the National Assessment and Accreditation Council (NAAC).

Green Auditing of a Higher Education Institution is a mandated activity as per Criterion VII under the 'Guidelines for Submission' of the mandatory annual Internal Quality Assurance Report (IQAR) by all Accredited Institutions in India.

The Nature's Green Guardians Foundation (NGGF_n) was invited to partner with NSS College greening team to maximize their efforts to attain a deeper shade of green. NGGF_n treats a college campus as "green", only if its performance is attuned to excellence and efficiency in the use of land and water resources, energy including renewables, etc., and based on students' state of health, environmental quality, gender equity, greener transportation & communication, as well as accessibility for the differently-abled.

Green Audit is undoubtedly the best route for grappling with the fast-changing situations. It is also a useful tool to know how and where an institution is using the most of energy, water, and other resources.

The Green Audit process at NSS College for 2022-'23, even with looming COVID-19 threats, involved the getting together of environment conscious student groups in the form of 'Club Green Guardians', and guiding them to take responsibility for catalyzing the college community into greening.

The results showed that, the NSS College, in Nemmara, Palakkad district is naturally in a green niche of 38 acre, but the road to make it a perfect place of green on all aspects of comprehensive green auditing, is a rough road to trek. All stakeholders including the management may lay more emphasis on the suggestions related to Carbon Footprint Remediation. There is enough room for taking the campus systems to near total efficiency.

The Audit has indicated the very low *effective per capita carbon footprint during 2022-'23 at just 0.028 T CO₂ eq., compared to the per capita national average of 1.91 T CO₂eq* (in 2022). More efforts if put in during the coming years, can take the shade of green to carbon neutrality.

The Audit has made a number of observations in the respective chapters on component audits, to embrace speedier routes to reach carbon neutrality within a shorter target period.

Prof. V K Damodaran

Chairman, NGGFN

Former (Founder) Director of S&T and Environment Department, Kerala

Former (Founder) Director of Energy Management Centre-Kerala

Former Secretary to Govt. of Kerala (Ex-Officio)

International Energy & Environment Expert

Ex-Consultant to UNIDO & UNEP

Trivandrum, 695035. Dated: 30.11.2023

Audit Team for NSS Nemmara Green Audit 2022-23

Dr. T Sreekumar, Principal

Smt. Thulasi K A, Principal

Dr. Sreedevi N Kutty, IQAC Coordinator

Prof. V K Damodaran, Chairman, NGGFN

Dr Sabu T, Program Director, CED

Mr Hari Prabhakaran P S, ISO 14001 Lead Auditor

Er A M Narayanan, Former Director, ANERT

Er K Madhukrishnan, CEO, Herbal Heritage Homes

Mr Ramkamal Manoj, Managing Trustee, Chakshumathi

Campus Green Protocol

1. **Waste Segregation:** Encourage students and staff to segregate waste in to categories like recyclables, non-recyclables and organic waste to promote proper disposal.
2. **Recycling Bins:** Place recycling bins for paper, plastic and glass at strategic locations throughout the campus.
3. **Reduce Single use Plastics:** Minimize the use of single use plastics like plastic bags, bottles and cutlery on campus.
4. **Water Conservation:** Encourage water saving practices such as fixing leaky faucets, installing lo flow fixtures and promoting responsible water usage.
5. **Energy Efficiency:** Promote energy efficient lighting and appliances and encourage turning off lights and electronics when not in use.
6. **Green Transportation:** Encourage students and staffs to use public transportation, car pool or bike to reduce carbon emission.
7. **Tree Planting:** Organise tree planting events to increase green cover on the campus and offset carbon emissions.
8. **Sustainable Events:** Promote eco-friendly practices during college events, such as using reusable decorations and reducing food waste.
9. **Environmental education:** Incorporate environmental education in to the curriculum and conduct awareness programs and workshops on sustainability.
10. **Reduce Paper Usage:** Encourage digital communication and documentation to reduce paper usage, and use recycled paper when necessary.



Green Audit 2022 – '23: Procedures and Priorities

The priorities of the College management, teachers, and the students are suggested, so as to commit to the keeping of premises as a “Green Campus”, contributing towards environmental conservation and sustainable development.

Towards Detailed Green Auditing

Maximizing the performance efficiency through conservation is the broad objective of the management. The ‘green auditing’ is done for the academic year 2021 - '22, even though the COVID-19 pandemic partially disrupted the regular routines of teaching and learning throughout the academic year. The stakeholders of this College agree to ensure the following:

- a) Enhancement and coordination among various activities of the College institution with importance given to ecological considerations and resources conservation;
- b) Institutionalizing all good practices initiated as part of review of activities;
- c) Driving a strong decision-making approach on the basis of ‘life cycle cost’ analysis on institutional issues; and
- d) Acceptance of a dynamic system for functional and lifestyle changes by the college stakeholders including the students.

The ultimate aim of the audit is to make the campus carbon neutral within a short time, by undertaking step by step activities based on the findings.

The Procedures and Priorities:

- a) Apart from the efficient use of energy, leading to substantial reduction in carbon footprint of the institution, renewable energy integration will be attempted for compensating the unavoidable imprints.
- b) The procedure for Green Auditing adopted by the team is to collect basic data on the components of green audit through the Student Green Guardians, compare the same with data maintained by the office, and then showcase the achievements - through statistical data, and photographs where possible.
- c) Set up feasible goals for the year ahead, and help to go up in steps.

Priorities: While all the listed green audit components are equally important, priority for the current audit was set on:

1. Evaluating the compliance potential of the stakeholders.
2. Examining in detail, the reduction in carbon footprint possible in at least three major areas which emerge as the main emitters.
3. Convincing the management on investment required, as well as the return on investment that is possible - through ‘Life Cycle Cost’ analysis.



Campus Population in 2022 - '23

Category	Male	Female	Other	Total
Students	354	969	16	1,339
Teaching Staff	15	60		75
Non-Teaching Staff	7	12		19
Total for 2022-23	376	1,041	16	1,433

Programmes in 2022 - '23

I	Post Graduate (PG) Programme
1	M A Commerce
2	M Sc Mathematics
3	M Sc Chemistry
II a	Undergraduate – B A Programme
1	B A History
2	B A English Literature
3	B A Economics
4	B A Malayalam Literature
II b	Under Graduate – B Sc Programme
1	B Sc Mathematics
2	B Sc Chemistry
3	B Sc Physics
4	B Sc Botany
5	B Sc Zoology
6	B Sc Instrumentation
II c	Under Graduate – B Com/B Voc Programme
1	B Com
2	BBA



1. Audit on Green Campus Initiatives

1.1. Campus Trespass Restrictions

NSS College in Nemmara, Palakkad, established in 1966, is known to the local people and the students for more than 55 years as a safe campus, conducive enough for serious study. It is a mixed college with 272 boys and 1087 girls students, tucked away in a vast rural campus setting. The people of Kerala have enormous respect for higher education. The entry to the campus, though not secured so tightly is open only to those who have any business to do there.



There is no possibility of any trespass, and there are no open entrances for the college campus academic area. Unauthorized entry or trespass has never been an issue during its long existence. Students for the very varied courses generally come from different strata of the society, but the campus discipline is very tight. In general, this rural campus is safe, and secure.

1.2 Use of Bicycles and EVs

The campus of NSS College, Nemmara, where public transport is easily accessible, the number of bicycles used by students is only 12, and two wheelers commuting are also comparatively low, at 25. Students walking to the college are around 85. Most students depend on public buses. It is well known that Kerala has 2.5% of India's population on its 1.2% of land area of the nation, and the people are highly mobile making it difficult for students to bicycle safely and leisurely.

The campus, at the foothills of a patch of hills, and students coming from other places do depend on buses. The roads in Kerala with very heavy traffic are not having designated walkways, and so, bicycle riding is not a comfortable exercise in Nemmara too. Kerala being of high population density region, with many roads lacking continuous and wide enough footpath or cycle tracks, parents also discourage their wards from the use of bicycles for daily commuting.

The number of registered motor vehicles in Kerala is over 15 million for a population of 35 million – of which 36% are motor bikes - and the annual road accidents reported in Kerala are over 40,000. These facts influence the parents while approving the choice of mode of travel to the college going children.

1.3. Pedestrian Friendly Pathways

For the present the NSS College Nemmara campus population of around 1,500, the roads and open spaces are more than enough, and with such a long time of existence, they are pedestrian friendly. Staff or students do not use motor vehicles for moving inside the campus.



1.4. Plastic Free Campus

The students, teachers, and all other stakeholders at NSS College, Nemmara, are committed to – as most other colleges in the State are - keeping all kinds of plastics at bay; especially the single-use type of plastics or other plastics-containing objects. They seriously adhere to the Campus Green Protocol.



Library is utilized by the students for serious study

2. Audit on Green Cover, Energy, Water & Environment

2.1. Biodiversity (Green Cover) Audit

Background

Biodiversity is essential for human subsistence. At present biodiversity is an area of major concern all over the world mainly because of the worldwide perception that the world's biodiversity is threatened more than ever before in human history, and nature and its vital contributions to people are deteriorating worldwide, as highlighted by various recent reports (CBD, 2020; EEA, 2019; IPBES, 2019; WWF, 2020). Emerging infectious disease (of humans) is a primary and current societal concern given the COVID-19 pandemic. The increase in events is more likely due to exponential growth of human activities (domestic/farmed animal population, environmental perturbation, and globalization), rather than any increase in the underlying rates of evolution of new pathogens from nature. Human activities such as habitat fragmentation, caused by urbanization and agriculture and the overexploitation of resources are the main cause of biodiversity loss. In order to create awareness among the youth on conservation of biodiversity there is a need for proper understanding on biological diversity conservation initiatives at local level.

The NSS College Nemmara is located at 10°35'25" N latitude and 76°34'41" E longitude, at Nemmara, Palakkad district of Kerala. The college campus with an area of 38 Acres is situated in the Palakkad Gap region of Western Ghats at an altitude of around MSL+120 m. The campus is maintaining very good vegetation and keeping an area intact with relatively untouched tree vegetation creating an atmosphere of forest. The main stakeholders viz., the students however, are very much conscious of the need to maintain the green surroundings for the entire campus with their efforts.

The present program to conduct a biodiversity audit of the college is not only intended to develop a biodiversity status report of the campus but also to create awareness among the students about the need for conservation of the biodiversity, and protecting the green areas in the campus by involving them in the participatory data collection activities. By providing hands-on training to students and staff on collecting data on biodiversity of the campus and finding the carbon sequestration potential of green vegetation will help in creating awareness on the role of biodiversity and ecosystems in mitigating climate change impacts.

The vegetation and soil of a green space can, not only sequester carbon directly contributing to a reduction in atmospheric CO₂ concentration, but also affect the carbon balance indirectly, through their effects on the energy balance and thus on CO₂ emissions related to energy use. In addition, these areas facilitate the health and well-

being of the people by alleviating stress and enabling relaxation. The maximum benefit of these spaces largely depends on judicious selection of an appropriate and diverse mix of tree species and their proper management in the campus.

Objectives

The major objective of the program is to conduct a participatory biodiversity audit of the institute by involving the students and staff and develop a report on the biodiversity status and its role in climate change mitigation.

The specific objectives are:

- To provide hands-on training to students and staff of the institute on collecting data on biodiversity of the campus and finding the carbon sequestration potential of green vegetation and its role in mitigating impacts of climate change
- To make the students capable of dealing with environmental and ecological issues
- To conduct a rapid survey on biodiversity composition of the campus and list out the species existing
- To find out the carbon sequestration potential of trees and other vegetation in the campus.
- To find out potential areas for Eco restoration within or outside the campus and frame future interventions
- To provide recommendations for future activities with respect to the scientific documentation of the campus biodiversity and activities to make the campus more biodiversity rich, with the involvement of students and faculty members.

Methods

Vegetation plays an important role in the reduction of carbon dioxide from atmosphere by carbon sequestration. Active absorption of CO₂ from the atmosphere through the process of photosynthesis and its subsequent storage in different plant parts in the form of biomass in growing plants is the carbon storage.

As an initial step towards conducting the survey of plants in the campus, the students were trained to take stock of the floristic elements of the campus by walking through the campus in groups and noting the plants with their local names. Photographs of the unidentified elements were taken to be identified by expert group.

Both woody and herbaceous vegetation are present in land uses inside campus sequester carbon, but for the purposes of this assessment, trees on alone is considered. This is because the carbon stored in the woody components of trees makes up the largest compartment of standing biomass stocks and annual biomass increment in the Non-Forest Land uses. Also, the other carbon pools and emissions sources like soil carbon emissions, fires etc. are not covered.

The girth of each tree at breast height (132 cm) was noted with its local/botanical name. Trees having girth 15 cm or more alone is considered for calculating carbon sequestration. The data collected were compiled by expert team and based on which the following analysis were done using standard procedures:

1. Botanical identity of plants collected with common names
2. Status of plants based on its origin/distribution
3. Total number of tree species present in each species (For Bamboos number of clumps are considered)
4. Girth Range at Breast Height in cm (For Bamboos Girth Range of Clumps at Breast Height in meters is taken & for Palms Trunk height Range in meters is taken)
5. The assessment of biomass equations for the efforts to improve carbon budget estimates is based on the link between individual-tree and whole-stand biomass estimates, coupled with the assumption that wood mass is about 49% carbon (Table 4.3 - IPCC, 2006/2019). Thus, the total carbon dioxide sequestered by the trees so far is arrived by:
 - a. Calculating the above ground biomass (AGB) of each tree using simple Allometric equation mixed tree species stands - $AGB = (0.18D^{2.16}) * 1.32$ (Brahma B,2021)
 - b. The below ground biomass (BGB) is taken as 28% of AGB [(Table 4.4 -IPCC, 2019) (Average high density and low-density plantations)].
 - c. Carbon content of trees is assumed as 49% of the total biomass, from which CO₂ equivalent is find out by multiplying it with 44/12.
6. The annual carbon sequestration potential is roughly estimated by using following assumptions:
 - a. Dicot tree sequester on the average 22 kg of carbon dioxide/year.
 - b. Coconut Palm sequester around 10 kg of carbon dioxide per year
 - c. Areca nut and other Palms sequester around 4 kg of carbon dioxide per year
 - d. One Bamboo culm will sequester 3 kg of carbon dioxide per year

Findings on Campus Floristic Diversity

A detailed account on the results of rapid assessment of the floral diversity of the campus is given in Table 2.1.1. The assessment revealed the following:

1. 147 species of vascular plants (132 Dicots,12 Monocots, 2 Gymnosperm and 1 Pteridophyte) belonging to 57 families were identified.
2. The highest species diversity is in the family Fabaceae (20 spp) followed by Euphorbiaceae (12 spp), Asteraceae (11 spp), Apocynaceae (8 spp), Malvaceae and Rubiaceae (7 spp each) and Poaceae (5 spp). 2 families are represented by 4 spp each, 5 families by 3 species, 12 families by 2 species and the remaining 30 families have only 1 species.

Table 2.1.1: Floristic Diversity

SI No	Botanical Name	Local Name	Family	Habit	origin	Habitat	System of Medicine used
1	<i>Abrus precatorius</i> L.	Kunni-Bead Vine	Fabaceae	Climber	Native	Wild	Ayurveda, Folk, Homeopathy, Sidha, Tibetan and Unani
2	<i>Acalypha indica</i> L.	Kuppameni - Indian Acalypha	Euphorbiaceae	Herb	Native	Wild	Ayurveda, Siddha, Folk, Homeopathy
3	<i>Achyranthes aspera</i> L.	Vankadaladi	Amaranthaceae	Herb	Native	Wild	Ayurveda, Siddha, Unani, Folk, Homeopathy, Sowa Rigpa, Chinese
4	<i>Adina cordifolia</i> (Roxb.) Hook. f. ex Brand.	Barakuram, Manjakadam bu	Rubiaceae	Tree	Native	Wild	Ayurveda and Folk
5	<i>Aegle marmelos</i> (L.) Corrêa	Koovalam-Bael tree	Rutaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Homeopathy, Sowa Rigpa
6	<i>Ageratum conyzoides</i> L.	Kumminnicha - Goat weed	Asteraceae	Herb	Exotic	Wild	Ayurveda, Siddha, Folk, Chinese
7	<i>Aglaomorpha quercifolia</i>	Drynaria	Polypodiaceae	Herb	Native	Wild	Ayurveda, Folk,
8	<i>Ailanthus triphysa</i> (Dennst.) Alston	Matti, Perumaram-Mattipaul	Simaroubaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Folk
9	<i>Albizia lebeck</i> (L.) Benth.	Vaka-Lebbek tree	Fabaceae	Tree	Native	Cultivated	Ayurveda and Sidha

Sl No	Botanical Name	Local Name	Family	Habit	origin	Habitat	System of Medicine used
10	<i>Allamanda cathartica L.</i>	Kolambichedi -Allamanda	Apocynaceae	Climber	Exotic	Cultivated	
11	<i>Alstonia scholaris (L.) R. Br</i>	Ezhilampla-Devil tree	Apocynaceae	Tree	Native	Wild	Ayurveda, Folk, Homeopathy, Tibetan, Unani and Sidha
12	<i>Alternanthera ficoidea</i>		Amaranthaceae	Herb	Exotic	Cultivated	
13	<i>Alternanthera sessilis (L.) R. Br. ex. DC.</i>	Ponnamkannicheera-Sessile joyweed	Amaranthaceae	Herb	Native	Wild	Ayurveda, Siddha, Folk, Sowa Rigpa, Chinese
14	<i>Ammannia baccifera L.</i>	Kalluruvi -Blistering ammania	Lythraceae	Herb	Native	Wild	Ayurveda, Siddha, Chinese
15	<i>Anacardium occidentale L.</i>	Parangimavu /Kasumavu-Cashew Tree	Anacardiaceae	Tree	Exotic	Cultivated	Ayurveda, Siddha, Folk, Homeopathy, Chinese
16	<i>Apluda mutica L</i>		Poaceae	Herb	Native	Wild	
17	<i>Aristolochia indica L.</i>	Gharudakodi -Indian birthwort	Aristolochiaceae	Climber	Native	Wild	Ayurveda, Folk, Tibetan, Unani and Sidha
18	<i>Asystasia gangetica (L.) Anders.</i>	Upputhali	Acanthaceae	Herb	Native	Wild	Ayurveda, Siddha, Folk
19	<i>Azadirachta indica A.Juss.</i>	Aaruvepp-Neem	Meliaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Homeopathy, Sowa Rigpa
20	<i>Bambusa bambos (L.) Voss</i>	Mula -Thorny bamboo	Poaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk

Sl No	Botanical Name	Local Name	Family	Habit	origin	Habitat	System of Medicine used
21	<i>Bauhinia purpurea L.</i>	Purple Bauhinia, Butterfly/Orchid tree	Fabaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Folk, Sowa Rigpa
22	<i>Bidens biternata (Lour.) Merr. & Sheriff</i>	Kandavarekuthi - Spanish Needles	Asteraceae	Herb	Native	Wild	Folk, Chinese
23	<i>Biophytum sensitivum (L.) DC</i>	Mukkuty	Oxalidaceae	Herb	Native	Wild	Ayurveda, Sidha, Folk
24	<i>Blumea axillaris (Lam.) DC.</i>		Asteraceae	Herb	Native	Wild	
25	<i>Boerhavia diffusa L.</i>	Thazuthama-Pigweed	Nyctaginaceae	Herb	Native	Wild	Ayurveda, Folk, Sidha, Homeopathy and Unani
26	<i>Bombax ceiba L.</i>	Elavu, Panjimaram - Red silk cotton/Kapok tree	Bombacaceae	Tree	Native	Wild	Ayurveda, Siddha, Unani, Folk, Sowa Rigpa
27	<i>Bougainvillea spectabilis Willd</i>	Kadalsupoo vu	Nyctaginaceae	shrub	Exotic	Cultivated	Folk, Sidha
28	<i>Briedelia retusa (L.) A. Juss.</i>	Mulluvenga, Kazhani	Euphorbiaceae	Tree	Native	Wild	Ayurveda, Folk
29	<i>Caladium bicolor (Ait. ex Dryand.) Vent.</i>	Varnachembu	Araceae	Herb	Exotic	Wild	
30	<i>Calopogonium mucunoides Desv</i>	Calopo	Fabaceae	Climber	Exotic	Wild	
31	<i>Calotropis gigantea (L.) W.T.Aiton</i>	Erukk-Crown Flower	Asclepiadaceae	Shrub	Native	Cultivated	Ayurveda, Siddha
32	<i>Canthium coromandelicum (Burm.f.) Alston</i>	Karamullu	Rubiaceae	Shrub	Native	Wild	Ayurveda, Siddha, Folk
33	<i>Cardiospermum halicacabum L.,</i>	Uzhinja-Heart's Pea	Sapindaceae	Climber	Native	Wild	Ayurveda, Folk, Homeopathy, Unani and Sidha
34	<i>Careya arborea</i>	Pezhu	Lecythidaceae	Tree	Native	Wild	Ayurveda, Folk and Sidha

Sl No	Botanical Name	Local Name	Family	Habit	origin	Habitat	System of Medicine used
35	<i>Cassia fistula L.</i>	Kanikonna-Golden shower	Fabaceae	Tree	Native	Cultivated	Ayurveda, Folk, Tibetan, Unani and Sidha
36	<i>Cassine albens</i>	Karuneerakam	Celastraceae	Tree	Native	Wild	Ayurveda, Folk and Sidha
37	<i>Catharanthus roseus (L.) G. Don</i>	Nithyakalyani - Madagascar Periwinkle	Apocynaceae	Herb	Exotic	Cultivated	Ayurveda, Folk and Modern
38	<i>Centella asiatica (L.) Urban</i>	Kudakan-Asiatic Pennywort	Apiaceae	Herb	Native	Wild	Ayurveda, Folk, Homeopathy, Tibetan, Sidha and Modern
39	<i>Chromolaena odorata (L.) King & Robins</i>	Communist pacha-Siam weed	Asteraceae	shrub	Exotic	Wild	
40	<i>Citrus limon (L.) Burm. f.</i>	Cherunarakam -Lemon tree	Rutaceae	Tree	Native	Cultivated	Ayurveda, Unani, Folk, Homeopathy, Sowa Rigpa, Chinese, Modern
41	<i>Cleistanthus collinus</i>	Odaku	Euphorbiaceae	Tree	Native	Wild	Used in Ayurveda and Sidha medicine
42	<i>Cleome viscosa</i>	Manjavela	Capparaceae	Herb	Native	Wild	Ayurveda, Siddha, Unani, Folk
43	<i>Clerodendrum infortunatum L.</i>	Peruvilam	Verbenaceae	shrub	Native	Wild	Ayurveda, Folk, Homeopathy and Sidha
44	<i>Clitoria ternatea L.</i>	Sankupushpam -Asian pigeonwings	Fabaceae	Climber	Exotic	Cultivated	Ayurveda, Folk, Tibetan, Unani and Sidha
45	<i>Coccinia grandis (L.) Voight,</i>	Koval	Cucurbitaceae	Climber	Native	Cultivated	Ayurveda, Homeopathy and Sidha

Sl No	Botanical Name	Local Name	Family	Habit	origin	Habitat	System of Medicine used
46	<i>Cocos nucifera L.</i>	Thengu - Coconut tree	Areaceae	Tree	Native	Cultivated	Ayurveda, Folk, Tibetan, Unani and Sidha
47	<i>Colocasia esculenta (L.) Schott</i>	Chembu - Wild Taro	Araceae	Herb	Native	Wild	Ayurveda, Folk, Unani and Sidha
48	<i>Corchorus aestuans L.</i>	Annual jute	Malvaceae	Herb	Native	Wild	
49	<i>Curculigo orchioides Gaertn.</i>	Nilappana - Black musale	Hypoxidaceae	Herb	Native	Wild	Ayurveda, Siddha, Unani, Folk, Sowa Rigpa, Chinese
50	<i>Curcuma longa L.</i>	Manjal	Zingiberaceae	Herb	Native	Cultivated	Ayurveda, Folk, Homeopathy, Tibetan, Unani and Sidha
51	<i>Cyanthillium cinereum</i>	Poovankurunila-Purple fleabane	Asteraceae	Herb	Native	Wild	Ayurveda, Siddha, Unani, Folk, Sowa Rigpa, Chinese
52	<i>Cycas circinalis L.</i>	Eenth-False Sago	Cycadaceae	Tree	Native	Cultivated	Ayurveda, Folk and Sidha
53	<i>Cyclea peltata (Lam.) Hook. f. & Thoms.</i>	Padakizhang u -Pata root	Menispermaceae	Climber	Native	Wild	Ayurveda, Folk and Sidha
54	<i>Cynanchum annularium (Roxb.) Liede & Khanum</i>	Adakkodien-Holostemma	Apocynaceae	Climber	Native	Wild	Ayurveda and Folk
55	<i>Cynodon dactylon (L.) Pers</i>	Karukapullu -Scutch grass	Poaceae	Herb	Native	Wild	Ayurveda, Folk, Sidha Homeopathy, Tibetan, Unani
56	<i>Cyperus rotundus</i>	Muthangapullu -Nut grass	Cyperaceae	Herb	Native	Wild	Ayurveda, Siddha, Unani, Sowa Rigpa, Chinese

Sl No	Botanical Name	Local Name	Family	Habit	origin	Habitat	System of Medicine used
57	<i>Datura stramonium L.</i>	Ummam-Thorn Apple	Solanaceae	shrub	Exotic	Cultivated	Ayurveda, Folk, Homeopathy, Unani and Sidha
58	<i>Delonix regia (Bojer ex Hook.) Raf.</i>	Poovaka -Gul Mohur	Fabaceae	Tree	Exotic	Cultivated	
59	<i>Dendrophthoe falcata (L. f.) Etting.</i>	Itthikanni - Mistletoe	Loranthaceae	Parasitic shrub	Native	Wild	Ayurveda and Folk
60	<i>Diospyros melanoxylon Roxb. Var. melanoxylon; C.B. Clarke</i>	Beediyilamar am-Coromandel ebony	Ebenaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Sowa Rigpa
61	<i>Emilia sonchifolia (L.) DC.</i>	Muyalcheviyan -Lilac tasselflower	Asteraceae	Herb	Native	Wild	Ayurveda, Folk and Sidha
62	<i>Euphorbia heterophylla L.</i>		Euphorbiaceae	Herb	Exotic	Wild	
63	<i>Euphorbia hirta L.</i>	Nilappala - Dove milk	Euphorbiaceae	Herb	Exotic	Wild	Ayurveda, Siddha, Unani, Folk, Chinese
64	<i>Evolvulus nummularius (L.) L.</i>	Vellakranthi	Convolvulaceae	Herb	Native	Wild	Ayurveda
65	<i>Ficus exasperata Vahl</i>	Parakam - Sandpaper tree	Moraceae	Tree	Native	Wild	Ayurveda, Siddha, Folk
66	<i>Ficus religiosa L.</i>	Arayaal - Sacred fig	Moraceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Homeopathy, Sowa Rigpa, Chinese
67	<i>Getonia floribunda Roxb.</i>	Pullaini	Combretaceae	Climber	Native	Wild	Ayurveda, Folk
68	<i>Gliricidia sepium (Jacq.) Kunth ex Walp</i>	Seema konna -Spotted Gliricidia	Fabaceae	Tree	Exotic	Wild	Folk

Sl No	Botanical Name	Local Name	Family	Habit	origin	Habitat	System of Medicine used
69	<i>Gmelina arborea</i> <i>Roxb. ex Sm.</i>	Kumbil - Candahar tree, Cashmeri teak	Lamiaceae	Tree	Nati ve	Cultiv ated	Ayurveda, Siddha, Folk, Sowa Rigpa
70	<i>Gomphrena</i> <i>serrata L</i>	Kaattuvadam alli	Amaranthaceae	Herb	Nati ve	Wild	Folk
71	<i>Grewia tiliifolia</i> Vahl	Chadachi	Malvaceae	Tree	Nati ve	Wild	Ayurveda, Folk and Sidha
72	<i>Grona triflora</i> (L.) H.Ohashi & K.Ohashi	Cherupulladi -Three flowered begger weed	Fabaceae	Herb	Nati ve	Wild	Ayurveda, Siddha, Folk
73	<i>Hardwickia binata</i> Roxb.	Achamaram- Indian blackwood	Fabaceae	Tree	Nati ve	Wild	Ayurveda and Sidha
74	<i>Helicteres isora L</i>	Idampiri valampiri- Indian screw tree	Malvaceae	shrub	Nati ve	Cultiv ated	Ayurveda
75	<i>Hemidesmus</i> <i>indicus (L.) R. Br</i>	Naruneendi - Indian sarsaparilla	Asclepiadaceae	Herb	Nati ve	Wild	Ayurveda, Folk, Tibetian, Unani and Sidha
76	<i>Hesperocyparis</i> <i>macrocarpa</i> (Hartw.) Bartel	Monterey cypress	Cupressaceae	Tree	Exot ic	Cultiv ated	
77	<i>Heteropogon</i> <i>contortus (L.) P.</i> <i>Beauv. ex Roem.</i> & <i>Schult.</i>	Oosipullu- Spear grass	Poaceae	Herb	Nati ve	Wild	Folk
78	<i>Hevea braziliensis</i> (Willd. ex A. Juss.) Muell.-Arg.	Rubber tree	Euphorbiaceae	Tree	Exot ic	Cultiv ated	
79	<i>Hibiscus rosa-</i> <i>sinensis L.</i>	Chembarathi - Shoeblackpla nt	Malvaceae	shrub	Nati ve	Cultiv ated	Ayurveda, Folk, Unani and Sidha
80	<i>Holarrhena</i> <i>pubescens</i> (Buch.-Ham.) Wall. ex G. Don	Kudagapala	Apocynaceae	Tree	Nati ve	Wild	Ayurveda, Folk, Homeopath y, Tibetan, Unani and Sidha
81	<i>Impatiens</i> <i>balsamina L.</i>	Balsam	Balsaminaceae	Herb	Nati ve	Cultiv ated	Ayurveda, Unani and Sidha

Sl No	Botanical Name	Local Name	Family	Habit	origin	Habitat	System of Medicine used
82	<i>Ipomoea obscura</i> (L.) Ker Gawl.	Thiruthali-Wild petunia	Convolvulaceae	Climber	Native	Wild	Ayurveda, Siddha, Folk
83	<i>Ixora coccinea</i> L.	Kattuthetti - West Indian Jasmine	Rubiaceae	shrub	Native	Wild	Ayurveda, Folk and Sidha
84	<i>Jasminum sambac</i> (L.) Ait.	Kudamulla-Sambac jasmine	Oleaceae	Climber	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Sowa Rigpa, Chinese
85	<i>Justicia gendarussa</i> Burm. f.	Vathamkolli	Acanthaceae	Shrub	Native	Cultivated	Ayurveda, Folk, Unani and Sidha
86	<i>Lantana camara</i> L.	Kongini - Lantana	Verbenaceae	shrub	Exotic	Wild	Ayurveda and Folk
87	<i>Leucaena leucocephala</i> (Lam.) de Wit	Ippilippil - Subaul	Fabaceae	Tree	Exotic	Cultivated	
88	<i>Leucas aspera</i> (Willd.) Link	Thumba	Lamiaceae	Herb	Native	Wild	Ayurveda, Siddha, Homeopathy, Folk, Veterinary
89	<i>Libidibia coriaria</i> (Jacq.) Schltdl.	Dividivi plant - American sumac	Fabaceae	Tree	Exotic	Cultivated	Siddha, Unani
90	<i>Mangifera indica</i> L.	Mavu - Mango Tree	Anacardiaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Homeopathy, Folk, Tibetan, Veterinary
91	<i>Memecylon umbellatum</i> Burm. F	Kayampoo, Kasavu-Ironwood tree	Melastomataceae	Tree	Native	Wild	Ayurveda, Folk, Sidha
92	<i>Mikania micrantha</i> Kunth	Vayara - Bittervine	Asteraceae	Climber	Exotic	Wild	
93	<i>Mimosa pudica</i> L.	Thottavady - Shameplant	Fabaceae	Herb	Native	Wild	Ayurveda, Siddha, Folk, Tibetan, Chinese
94	<i>Mitracarpus hirtus</i> (L.) DC. Thaaval		Rubiaceae	Herb	Exotic	Wild	Folk

95	<i>Monoon longifolium (Sonn.) B.Xue & R.M.K.Saunders</i>	Arana maram-Indian mast tree	Annonaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Folk
96	<i>Morinda pubescens J. E. Smith</i>	Manjanaathi	Rubiaceae	Tree	Native	Wild	Ayurveda, Siddha, Folk
97	<i>Nerium oleander L.</i>	Arali - Oleander	Apocynaceae	shrub	Native	Cultivated	Ayurveda, Homeopathy, Folk, Veterinary
98	<i>Ocimum tenuiflorum L.</i>	Krishnathulasi -Holybasil	Lamiaceae	Herb	Native	Cultivated	Ayurveda, Siddha, Unani, Homeopathy, Folk, Tibetan, Chinese
99	<i>Oldenlandia corymbosa L.</i>	Parpadakapullu-Onathumba	Rubiaceae	Herb	Native	Wild	Ayurveda, Siddha, Chinese
100	<i>Panicum notatum Retz.</i>		Poaceae	Herb	Native	Wild	
101	<i>Passiflora edulis l.</i>	Passion fruit	Passifloraceae	Climber	Exotic	Cultivated	Ayurveda, Folk
102	<i>Passiflora foetida L.</i>	Poodappazham-Popwine	Passifloraceae	Climber	Exotic	Wild	Ayurveda, Siddha, Folk, Chinese
103	<i>Peltophorum pterocarpum (DC.) Backer ex Heyne</i>	Charakonna -Yellow Flame Tree	Fabaceae	Tree	Exotic	Cultivated	Siddha, Folk
104	<i>Peperomia pellucida</i>	Mashithand	Piperaceae	Herb	Exotic	Wild	Folk
105	<i>Phyllanthus amarus Schum. & Thonn.</i>	Keezharnelligale of the wind	Euphorbiaceae	Herb	Native	Wild	Ayurveda, Siddha, Folk, Sowa Rigpa
106	<i>Phyllanthus emblica L.</i>	Nelli-Indian gooseberry	Euphorbiaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk Chinese
107	<i>Phyllanthus myrtifolius Moon</i>	Hedge Phyllanthus	Euphorbiaceae	shrub	Exotic	Cultivated	
108	<i>Phyllanthus urinaria L.</i>	Chuvannakizhanelli	Euphorbiaceae	Herb	Native	Wild	Ayurveda, Siddha, Chinese
109	<i>Pigea enneasperma (L.) P.I. Forst.</i>	Orilathamara -Spade flower	Violaceae	Herb	Native	Wild	Ayurveda, Folk and Sidha
110	<i>Pilea microphylla (L.) Liebm.</i>	Artillery Plant	Urticaceae	Herb	Exotic	Wild	
111	<i>Plumeria rubra L.</i>	Alari, Ezha champakam-Frangipani	Apocynaceae	Tree	Exotic	Cultivated	Ayurveda, Siddha, Folk

112	<i>Pongamia pinnata</i> (L.) Pierre	Pongu, Ungu -Indian beech tree	Fabaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Tibetan, Chinese
113	<i>Pouzolzia zeylanica</i> (L.) Bennett	Neycheera	Urticaceae	Herb	Native	Wild	Folk, Chinese
114	<i>Psidium guajava</i> L.	Peramaram - Guajava	Myrtaceae	Tree	Exotic	Cultivated	
115	<i>Ricinus communis</i> L.	Avanakku-Castor oil plant	Euphorbiaceae	Shrub	Exotic	Wild	Ayurveda, Siddha, Unani, Homeopathy, Folk, Tibetan, Modern, Chinese
116	<i>Samanea saman</i> (Jacq.) Merr	Mazhamaram -Rain tree	Fabaceae	Tree	Exotic	Cultivated	
117	<i>Santalum album</i> L.	Chandanamaram - Sandal tree	Santalaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Homeopathy, Sowa Rigpa, Chinese, Modern
118	<i>Saraca asoca</i> (Roxb.) de Wilde	Ashokam-Ashoka tree	Fabaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Homeopathy, Folk
119	<i>Scoparia dulcis</i> L.	Kallurikki - Liquorice weed	Scrophulariaceae	Herb	Native	Wild	Ayurveda, Folk, Sidha, Chinese
120	<i>Senna occidentalis</i> (L.) Link	Karinthakara , Ponnnaviram	Fabaceae	shrub	Exotic	Wild	Ayurveda, Siddha, Folk, Tibetan, Chinese
121	<i>Sida acuta</i> Burm.f.	Malamkurun thotti - Broom plant	Malvaceae	shrub	Native	Wild	Ayurveda, Siddha, Folk, Chinese
122	<i>Sida cordata</i> (Burm.f.) Borss.Waalk.	Vallikurumthotti	Malvaceae	Herb	Native	Wild	Ayurveda, Siddha, Folk
123	<i>Simarouba glauca</i> DC.	Lekshmitharu- Paradise-tree	Simaroubaceae	Tree	Exotic	Cultivated	Folk
124	<i>Spermacoce latifolia</i> Aubl.	Tharavu	Rubiaceae	Herb	Native	Wild	



125	<i>Strychnos nux-vomica L.</i>	Kanjiram - Poison nut	Loganiaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Homeopathy, Sowa Rigpa, Chinese, Modern
126	<i>Swietenia macrophylla King</i>	Mahagoni	Meliaceae	Tree	Exotic	Cultivated	Siddha, Folk
127	<i>Synedrella nodiflora (L.) Gaertn.</i>	Mudianpacha	Asteraceae	Herb	Exotic	Wild	Folk, Chinese
128	<i>Syzygium cumini (L.) Skeels</i>	Njaval -Black plum	Myrtaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Homeopathy, Folk, Tibetan, Chinese
129	<i>Tagetes erecta L.</i>	Banthi - Marigold	Asteraceae	Herb	Exotic	Cultivated	Ayurveda, Siddha, Folk, Chinese
130	<i>Tecoma stans (L.) Juss. ex Kunth</i>	Manjarali-Trumpet-flower	Bignoniaceae	Shrub	Exotic	Cultivated	Siddha, Folk
131	<i>Tectona grandis L.</i>	Thekk -Teak	Verbenaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Tibetan
132	<i>Terminalia bellirica (Gaertn.) Roxb.</i>	Thanni	Combretaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk
133	<i>Terminalia chebula Retz.</i>	Kadukka - Chebulic myrobalan	Combretaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Homeopathy, Sowa Rigpa, Chinese
134	<i>Terminalia paniculata Roth</i>	Maruth-Flowering murdah	Combretaceae	Tree	Native	Wild	Ayurveda, Siddha, Folk
135	<i>Thespesia populnea (L.) Soland. ex Correa</i>	Cheelanthi, Pooparutthi-India tulip tree	Malvaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk
136	<i>Thunbergia grandiflora (Roxb. ex Rottl.) Roxb.</i>	Blue trumpet vine	Acanthaceae	Climber	Native	Cultivated	Folk, Chinese

137	<i>Tiliacora acuminata</i> (Poir.) Miers ex Hook. f. & Thoms.	Vallikanjiram	Menispermaceae	Climber	Native	Wild	
138	<i>Tinospora cordifolia</i> (Willd.) Miers.	Amrithavalli-Moon creeper	Menispermaceae	Climber	Native	Wild	Ayurveda, Siddha, Unani, Folk, Homeopathy, Sowa Rigpa
139	<i>Tragia involucrata</i> L.	Choriyanam -Indian stinging nettle	Euphorbiaceae	Herb	Native	Wild	Ayurveda, Siddha, Folk
140	<i>Tridax procumbens</i> L.	Kumminipac ha -Coat-button	Asteraceae	Herb	Exotic	Wild	Ayurveda, Siddha, Folk
141	<i>Vachellia leucophloea</i>	Vellavelam	Fabaceae	Tree	Native	Wild	Ayurveda, Siddha, Folk
142	<i>Wattakaka volubilis</i> (L.f.) Stapf	Kakkalankodi -Sneeze Wort	Asclepiadaceae	Climber	Native	Wild	Ayurveda, Siddha, Unani, Folk
143	<i>Wedelia trilobata</i> (L.) A. S. Hitchc	Amminippov -Trailing daisy/ Singapore daisy	Asteraceae	Herb	Exotic	Wild	
144	<i>Wrightia tinctoria</i>	Dhanthappala	Apocynaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Homeopathy
145	<i>Xylia xylocarpa</i> (Roxb.) Taub.	Irul	Fabaceae	Tree	Native	Cultivated	Ayurveda, Folk
146	<i>Ziziphus mauritiana</i> Lam.	Elantha-Jujube tree	Rhamnaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Sowa Rigpa
147	<i>Ziziphus oenopolia</i> (L.) Mill.	Thudali - Jackal jujube	Rhamnaceae	Climber	Native	Wild	Ayurveda, Siddha, Folk

- Out of the 147 species present in the campus, 56 are tree species, 53 herbs, 20 climbers, and the remaining 18 are shrubs (Fig. 1). This shows a moderately high diversity of trees species in the campus. This is due to the presence of a dense moderately untouched forested area in the campus.

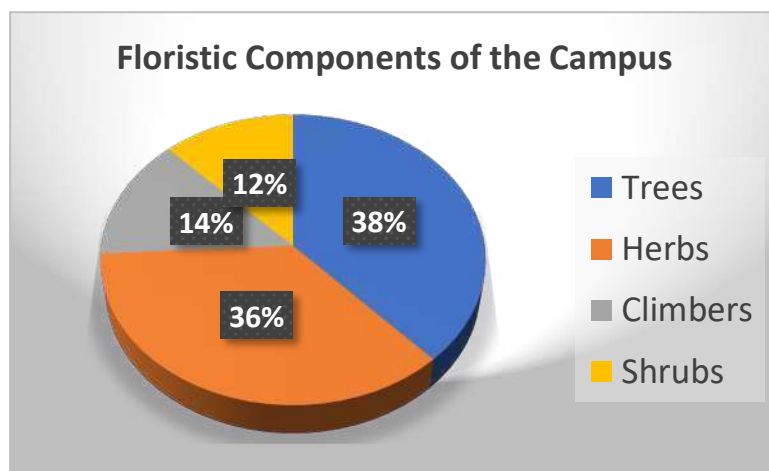


Fig. 1: Floristic Components of Campus

- The campus is maintaining very good natural biodiversity with 59% of the plants (86 spp) growing wild in the campus while 41% (61 spp) are cultivated by staff and students during various occasions.
- Out of the 147 taxa, 107 are native/indigenous plants (73%) and only 40 are exotic plants (27%). This is again a very good sign that natural vegetation is kept intact in the campus.

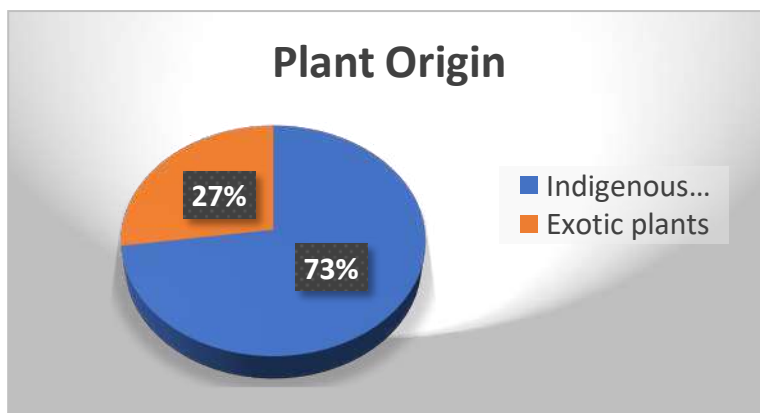


Fig. 2: Plant Origin

- Highest percentage of exotics found in Trees and herbs (32.5% each). In climbing species 20% are exotic and in shrubs 15%.
- It is also worth to mention that 98 taxa (67%) present in the campus are used in more than one Indian systems of medicines branches and another 6 taxa are popularly used in folk medicine alone. The contents from 6 taxa are used in modern medicine as well (*Catharanthus roseus*, *Centella asiatica*, *Citrus limon*, *Ricinus communis*, *Santalum album* and *Strychnos nux-vomica*). The details in Table 2.1.1.

Tree Diversity and Carbon Sequestration Potential

The major findings on tree diversity in the campus and its carbon sequestration potential are:

- Out of the 56 tree species present in the campus trees with more 15cm girth at breast height is represented by 50 species and 355 plants are found in the campus in this category. The details of trees with more than 15 cm height at present in the Campus, and total carbon sequestered are summarized in Table 2.1.2.

Table 2.1.2 Tree Diversity and Carbon Sequestration

Sl no	Name of the tree	No. of Trees	GBH Range (cm)	CO ₂ Sequestered (Ton)
1	<i>Aegle marmelos (L.) Corrêa</i>	13	42-107	9.26
2	<i>Adina cordifolia (Roxb.) Hook. f. ex Brand.</i>	4	36-60	0.9
3	<i>Ailanthus triphysa (Dennst.) Alston</i>	1	40	0.13
4	<i>Albizia lebbek (L.) Benth.</i>	1	107	0.05
5	<i>Alstonia scholaris (L.) R. Br.</i>	5	101-588	50.9
6	<i>Anacardium occidentale L.</i>	4	18-27	0.15
7	<i>Azadirachta indica A.Juss.</i>	19	23-177	43.9
8	<i>Bambusa bambos (L.) Voss</i>	2	36-39	0.23
9	<i>Bauhinia purpurea L.</i>	11	20-57	1.1
10	<i>Bombax ceiba L.</i>	3	36-47	0.4
11	<i>Briedelia retusa (L.) A. Juss.</i>	4	22-61	0.49
12	<i>Careya arborea</i>	4	25-27	0.21
13	<i>Cassia fistula L.</i>	5	20-27	0.22
14	<i>Cassine albens</i>	2	136-150	4.18
15	<i>Cleistanthus collinus</i>	14	35-353	37.2
16	<i>Cocos nucifera L.</i>	2	35-40	0.24
17	<i>Cycas circinalis L.</i>	1	73	0.1
18	<i>Delonix regia (Bojer ex Hook.) Raf.</i>	1	107	1.04
19	<i>Diospyros melanoxylon Roxb. Var.melanoxylon; C.B. Clarke</i>	1	39	0.13
20	<i>Ficus exasperata Vahl</i>	1	45	0.17
21	<i>Ficus religiosa L.</i>	1	151	0.18
22	<i>Gliricidia sepium (Jacq.) Kunth exWalp</i>	2	15-20	0.06
23	<i>Gmelina arborea Roxb. ex Sm.</i>	4	25-47	0.42
24	<i>Grewia tiliifolia Vahl</i>	7	15-37	0.5
25	<i>Hardwickia binata Roxb.</i>	1	42	0.15
26	<i>Hevea braziliensis (Willd. ex A. Juss.) Muell.-Arg.</i>	1	35	0.98
27	<i>Libidibia coriaria (Jacq.) Schltld.</i>	1	30	0.07
28	<i>Mangifera indica L.</i>	1	111	1.04
29	<i>Manilkara zapota (L.) P.Royen</i>	1	26	0.49
30	<i>Monoon longifolium (Sonn.) B.Xue & R.M.K.Saunders</i>	18	27-280	41.6

Sl no	Name of the tree	No. of Trees	GBH Range (cm)	CO ₂ Sequestered (Ton)
31	<i>Morinda pubescens</i> J. E. Smith	20	21-130	17.6
32	<i>Peltophorum pterocarpum</i> (DC.) Backer ex Heyne	1	379	0.11
33	<i>Phyllanthus emblica</i> L.	9	19-103	4.65
34	<i>Pongamia pinnata</i> (L.) Pierre	10	36-217	23.1
35	<i>Psidium guajava</i> L.	3	37-108	2.3
36	<i>Samanea saman</i> (Jacq.) Merr	6	21-222	9.84
37	<i>Santalum album</i> L.	2	16-21	0.05
38	<i>Saraca asoca</i> (Roxb.) de Wilde	15	27-280	57.7
39	<i>Simarouba glauca</i> DC.	1	213	4.93
40	<i>Strychnos nux-vomica</i> L.	2	30-51	0.31
41	<i>Swietenia macrophylla</i> King	1	144	17.1
42	<i>Syzygium cumini</i> (L.) Skeels	3	47-61	0.79
43	<i>Tectona grandis</i> L.	112	23-183	230
44	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	4	31-150	3.85
45	<i>Terminalia chebula</i> Retz.	6	27-71	0.55
46	<i>Terminalia paniculata</i> Roth	2	74-113	1.76
47	<i>Terminalia paniculata</i> Roth	4	74 -269	21.1
48	<i>Thespesia populnea</i> (L.) Soland. ex Correa	8	18-33	0.38
49	<i>Wrightia tinctoria</i>	6	25-83	0.22
50	<i>Ziziphus mauritiana</i> Lam.	5	23-40	0.36
Total		355	20-588	593.08

- Out of the 355 trees, 350 are Dicot trees, 4 Monocot trees and 1 Gymnosperm.
- The highest numbers of trees present are Teak (112), Morinda (20), Neem (19), and Indian mast tree (18).
- About 77% of the tree species present are planted for various purposes like shade, fruits, flower, climate change mitigation etc.
- It is also worth to mention that 94% of the trees present in the campus are belong to indigenous /native species.
- The girth of the trees ranges from 20 cm to 588 cm. and largest tree belong to *Alstonia scholaris* (Devil's Tree)
- The total carbon sequestered by all trees in the campus so far is only **593 ton**. Out these 230 tons are sequestered by 112 Teak trees in the campus.
- The present **annual carbon sequestration potential** of the Campus is estimated at around **8 ton**.



Out in the field for Biodiversity Audit with the Expert



Biodiversity preserved well, but opportunities exist for enriching it further
A part of the NSS Nemmara campus is a forest like green fortress

Faunal diversity

The flowering/fruit bearing plants present in the campus make it a suitable habitat for many animals. The campus is having a relatively very good faunal diversity. A detailed analysis of the faunal diversity is yet to be done. A random study on faunal diversity revealed the presence of 50 species. This includes 6 species of birds, 19 species of butterflies/moths, 3 species of spiders, 6 species of odonates, 10 species of ants, 2 species of mammals and 4 species of reptiles (Table 2.1.3).

Table 2.1.3 Faunal Diversity

Sl. No.	Zoological Name	Common Name	Family
BIRDS			
1	<i>Milvus migrans</i>	Black kite	Accipitridae
2	<i>Corvus splendens</i>	House crow	Corvidae
3	<i>Columba livia</i>	Rock pigeon	Columbidae
4	<i>Streptopelia chinensis</i>	Spotted dove	Columbidae
5	<i>Dendrocitta vagabunda</i>	Rufous treepie	Corvidae
6	<i>Merops orientalis</i>	Green Bee eater	Meropidae
BUTTERFLIES/MOTHS			
7	<i>Agathia laetata</i>	Alankarapacha	Geometridae
8	<i>Castalius rosimon</i>	Common Pierrot	Lycaenidae
9	<i>Zizula hylax</i>	Tiny grass blue	Lycaenidae
10	<i>Ariadne ariadne</i>	Angled Castor	Nymphalidae
11	<i>Euploea core</i>	Common Crow	Nymphalidae
12	<i>Euthalia Aconthea</i>	Common Baron	Nymphalidae
13	<i>Melanitis leda</i>	Common Evening Brown	Nymphalidae
14	<i>Mycalesis perseus</i>	Common Bush Brown	Nymphalidae
15	<i>Neptis hylax</i>	Common Sailor	Nymphalidae
16	<i>Orsotriaena medus</i>	Nigger/Medows Brown	Nymphalidae
17	<i>Parantica aglea</i>	Glassy Tiger	Nymphalidae
18	<i>Tirumala limniace</i>	Blue Tiger	Nymphalidae
19	<i>Tirumala septentrionis</i>	Dark Blue Tiger	Nymphalidae
20	<i>Ypthima baldus</i>	Common Five Ring	Nymphalidae
21	<i>Ypthima huebneri</i>	Common Four Ring	Nymphalidae
22	<i>Pachliopta hector</i>	Crimson rose	Papilionidae
23	<i>Delias eucharis</i>	Common Jezebel	Pieridae
24	<i>Eurema hecabe</i>	Common Grass Yellow	Pieridae
25	<i>Micronia aculeata</i>	Asian spotted swallow tailmoth	Uraniidae

SPIDERS			
26	<i>Eriovixia laglaizei</i>	Laglaise's garden spider	Araneidae
27	<i>Oxyopes javanus</i>	Lynx spider	Oxyopidae
28	<i>Leucauge fastigata</i>	Decorative silver orb spider	Tetragnathidae
ODONATES			
29	<i>Vestalis gracilis</i>	ear winged forest glory	alopterygidae
30	<i>Ceriagrion cerinorubellum</i>	Orange Tailed Marsh Dart	Coenagrionidae
31	<i>Diplacodes trivialis</i>	Blue Ground Skimmer	Libellulidae
32	<i>Neurothemis fulvia</i>	Fulvous forest Skimmer	Libellulidae
33	<i>Pantala flavescens</i>	Wandering glider	Libellulidae
34	<i>Potamarcha congener</i>	Yellow tailed Ashy Skimmer	Libellulidae
ANTS			
35	<i>Technomyrmex bicolor</i>	White-footed ant	Dolichoderinae
36	<i>Camponotus compressus</i>	Common Godzilla Ant	Formicinae
37	<i>Camponotus paria</i>	Carpenter ant	Formicinae
38	<i>Camponotus invidus</i>	Carpenter ant	Formicinae
39	<i>Polyrachis rupicapra</i>	Spiny ant	Formicinae
40	<i>Myrmecaria brunnea</i>	Hunchback Ant	Myrmicinae
41	<i>Lophomyrmex quadrispinosus</i>		Myrmicinae
42	<i>Solenopsis geminata</i>	Common Red Fire Ant	Myrmicinae
43	<i>Tetraoponera rufonigra</i>	Arboreal Bicoloured Ant	Pseudomyrmicinae
44	<i>Tetraoponera nigra</i>		Pseudomyrmicinae
MAMMALS			
45	<i>Canis lupus familiaris</i>	Indian Pariah dog	Canidae
46	<i>Funambulus palmarum</i>	Indian Palm Squirrel	Sciuridae
REPTILES			
47	<i>Trimeresurus strigatus</i>	Horse shoe pit viper	Viperidae
48	<i>Ophiophagus hannah</i>	Cobra	Elapidae
49	<i>Ptyas mucosa</i>	Indian rat snake	Colubridae
50	<i>Dieurostus dussumieri</i>	Desom kutty-Kandapampau	Colubridae- sf: Homalopsinae

Suggestions / Recommendations

1. Even though the Campus is having a good biodiversity, a detailed study is not yet conducted and the plants in the forested area is least explored.
2. It is essential to prepare a digital biodiversity register of the campus in a scientific way with photographs of all plants and visiting/nurturing animals. All plants shall be properly geo-tagged with QR codes, so that the students will get details about the plants and its uses and also the conservation importance.
3. This shall be properly maintained by the NSS/Eco-Club volunteers/Green Guardians and shall be periodically updated.
4. The trees in the campus shall be geo-tagged and monitored annually for girth increment so that we will get a real picture of annual carbon sequestration potential.
5. There are vacant spaces available in the campus and these areas shall be judiciously utilized for increasing the biodiversity.
6. In order to get maximum benefits out of biodiversity conservation there is a need for establishing more indigenous plants.
7. Planting diverse local species will help in more water conservation and increasing the faunal diversity and providing more ecosystem services. Some indigenous plant species growing in the Malappuram and Palakkad districts are suggested to be added to the campus biodiversity as given Table 2.1.4.
8. If possible, some tropical fruit trees suitable for the area shall also be planted which will help the students to understand the importance of local fruits and vegetables in their daily diet for healthy living.
9. As there are spaces available in the campus, it may try to assort and add attractive specialized gardens such as Butterfly Garden, Herbal/Medicinal Garden (May explore funding from National Medicinal plant Board for this), *Nakshatra Vanam*, etc. as well. This will help to explore the possibility for farm/educational tourism with well-maintained greenery in the campus in the hillock and to attract more students to the campus.
10. A “special campus greening drive” with fast growing forestation techniques like the “Miyawaki Model” also may be tried to keep the lead in the institution’s climate change mitigation activities. The campus has already initiated some activities in this direction, which must be further streamlined in a more scientific way.

Table 2.1.4: Native plants recommended for planting in vacant areas

Sl. No.	Botanical Name	Local/ English Name	Habit	Habitat	Nat. Distribution (Dist.)	Conservation Importance
1	<i>Alangium salviifolium</i>	Ankolam	Tree	Dry deciduous forests and homestead	All	Medicine, Food
2	<i>Anogeissus latifolia</i>	Kalkanjiram	Tree	Moist / dry deciduous forests	Except KSD, ALP, KTM	Medicine

Sl. No.	Botanical Name	Local/ English Name	Habit	Habitat	Nat. Distribution (Dist.)	Conservation Importance
3	<i>Antiaris toxicaria</i>	Karanjili, Maravuri	Tree	Evergreen /semi-evergreen forests and sacred groves	Except KSD, KKD, ALP, KTM	Medicine
4	<i>Antidesma bunius</i>	Mayilkombi, Neelathali	Tree	Evergreen forests, also in sacred groves	TVM and IDK to KSD	Food
5	<i>Aporosa cardiosperma (Gaertn.) Merr.</i>	Ponvetti, Vetti, Eachil Kotili	Tree	Semi-evergreen and evergreen forests, also in the plains	All	Medicine, Star tree-Triketta
6	<i>Ardisia solanacea Roxb.</i>	Kakkanjara	Shrub	Evergreen forests	KNR to TSR & KTM	Medicine, Bird's Attraction
7	<i>Artocarpus heterophyllus Lam.</i>	Plavu -Jack	Tree	Evergreen and semi-evergreen forests, also widely cultivated	All	Medicine, Food, Star tree-Uthradam
8	<i>Asparagus racemosus Willd.</i>	Shatavari	Climber	All forest types and plains	All	Medicine
9	<i>Atuna travancorica</i>	Kallankaimaram	Tree	Evergreen forests	PKD, TSR, IDK, KLM & TVM	Endangered, Endemic to Kerala
10	<i>Averrhoa carambola L.</i>	Chathurapuli	Tree	Exotic Cultivated	All	Medicine, Food
11	<i>Baccaurea courtallensis</i>	Moottippazham	Tree	Evergreen and semi-evergreen forests	All	Food, Star tree Visakham, Endemic to India, Endemic to Penninsular India
12	<i>Barringtonia acutangula</i>	Adambu, Attupezhu	Tree	Along riverbanks and water courses	All	Medicine
13	<i>Bergera koenigii L.</i>	Veppila - Curry leaf	Tree	Cultivated	All	Medicine
14	<i>Borassus flabellifer L.</i>	Karimpana - Palmyra Palm	Tree	Dry areas and along bunds in paddyfields	All	Medicine, Ind. Raw Mat., Star tree-Uthrattathi

Sl. No.	Botanical Name	Local/ English Name	Habit	Habitat	Nat. Distribution (Dist.)	Conservation Importance
15	<i>Butea monosperma (Lam.) Kuntze</i>	Chamatha, Plasu-Flame of the forest	Tree	Deciduous forests and plains	All	Medicine, Star tree-Pooram
16	<i>Calophyllum calaba</i>	Aattupunna, Cherupunna Manjapunna	Tree	Evergreen/ semi-evergreen forests and sacred groves	All	Medicine, Endemic to Western Ghats
17	<i>Carallia brachiata</i>	Vallabham	Tree	Semi-evergreen forests, also in the plains	All	Medicine
18	<i>Ceodes grandis</i>	Maracheera	Tree	Cultivated		Food
19	<i>Chionanthus mala-elengi (Dennst.) P.S.Green</i>	Kallidala Mala-elengi	Tree	Evergreen, semi-evergreen and moist deciduous forests	All	Endemic to Penninsular India, Medicine
20	<i>Cinnamomum malabatum (Burm. f.) Blume</i>	Vayana,Edana	Tree	Evergreen and semi-evergreen forests and plains	All	Endemic to Southern Western Ghats, Medicine
21	<i>Cissus quadrangularis L.</i>	Changalamparanta	Climber	Dry deciduous forests and plains	All	Medicine
22	<i>Cochlospermum religiosum</i>	Appakudukka	Tree	Moist and dry deciduous forests	Except KSD, ALP, PTA, KLM,KT M	Medicine
23	<i>Cordia dichotoma G.Forst.</i>	Moonjapasa, Cheruthekku	Tree	Dry deciduous forests and plains	All	Medicine
24	<i>Croton persimilis</i>	Somaraaji, Thomarayam	Tree	Scrub forests, also in the plains	KSD, MPM, TSR, EKM, ALP	Medicine
25	<i>Dendrocalamus giganteus Munro</i>	Gaint Bamboo	Tree	Cultivated	All	Food - Ind. Raw Mat.
26	<i>Dendrocalamus strictus (Roxb.) Nees,</i>	Kallanmula-Solid Bamboo	Tree	Deciduous forests and plains	IDK to KNR	Medicine, Food

Sl. No.	Botanical Name	Local/ English Name	Habit	Habitat	Nat. Distribution (Dist.)	Conservation Importance
27	<i>Dillenia pentagyna</i>	Malampunna	Tree	Deciduous forests	All	Medicine
28	<i>Diospyros candolleana</i>	Kari, Karimaram	Tree	Evergreen, semi-evergreen and moist deciduous forests	Except KNR & MPM	Vulnerable Endemic to Penninsular India, Medicine
29	<i>Ensete superbum (Roxb.) Cheesman.</i>	Kalluvazha - Wild plantain	shrub	Moist deciduous and semi-evergreen forests	Except ALP	Medicine
30	<i>Ficus beddomei King</i>	Thavittaal	Tree	Semi-evergreen forests	Except KSD, KTM, ALP, PTA, KLM	Endemic to Western Ghats, Bird's Attraction
31	<i>Ficus benghalensis L.</i>	Peral - Banyon tree	Tree	Dry deciduous forests, also in the plains	All	Medicine, Star tree-Makam
32	<i>Ficus racemosa L.</i>	Athi al, Jantuphalam	Tree	Semi-evergreen and deciduous forests, also in the plains	All	Medicine, Star tree-Karttika
33	<i>Ficus tinctoria subsp. gibbosa (Blume) Corner</i>	Kallitthi -Dye Fig, Itthimottu	Tree	Cultivated	PKD, TSR, EKM, IDK TVM	Medicine, Star tree-Uthram
34	<i>Flacourtia jangomas</i>	Loulokia - Puneala plum	Tree	Cultivated	All	Medicine, Food
35	<i>Flacourtia montana J.Graham</i>	Kattuloika, Charalpazham	Tree	Evergreen and semi-evergreen forests	All	Food, Star tree-Visakham, Endemic to India
36	<i>Garcinia gummi-gutta (L.) Robs</i>	Kudapuli-Malabar Gamboge	Tree	Evergreen forests, along stream banks, also cultivated	All	Medicine, Food
37	<i>Garuga pinnata</i>	Eechakkara , Karuvembu	Tree	Moist deciduous forests, also in the	All	Medicine

Sl. No.	Botanical Name	Local/ English Name	Habit	Habitat	Nat. Distribution (Dist.)	Conservation Importance
				plains		
38	<i>Glycosmis pentaphylla</i> (Retz.) DC.	Panal	shrub	Semi-evergreen /moist deciduous forests and plains	All	Medicine
39	<i>Hopea parviflora</i>	Kambagam, Thambagam	Tree	Evergreen and semi-evergreen forests and plains/Sacred groves	All	Endemic to Southern Western Ghats
40	<i>Hopea ponga</i>	Naithambagam, Kambakam	Tree	Evergreen and semi-evergreen forests and plains/Sacred groves	All	Endangered, Endemic to Southern Western Ghats
41	<i>Humboldtia bourdillonii</i>	Adimundan	Tree	Evergreen forests, along stream banks	IDK	Endangered, Endemic to Southern Western Ghats
42	<i>Humboldtia vahliana</i>	Karappongu Korathi	Tree	Along river banks in semi-evergreen/evergreen forests	Except KSD, WYD, KKD, MPM	Endangered, Endemic to Southern Western Ghats, Medicine
43	<i>Hymenodictyon orixense</i>	Chakka thekku	Tree	Deciduous forests and plains	All	Medicine
44	<i>Ixora coccinea</i> L.	Kattuthetti - West Indian Jasmine	shrub	Plains	All	Medicine
45	<i>Ixora javanica</i> (Blume) DC.	Ashokachetti -Jungle Geranium	shrub	Cultivated	All	Medicine
46	<i>Jasminum angustifolium</i> (L.) Willd.	Kattumulla	Climber	Scrub jungles, sacred groves and plains	All	Medicine
47	<i>Justicia adathoda</i> L.	Adalodakam-Malabar nut	shrub	Plains, often planted as hedge	All	Medicine
48	<i>Lagerstroemia indica</i>	Tindiyam	Tree	Cultivated	All	Medicine

Sl. No.	Botanical Name	Local/ English Name	Habit	Habitat	Nat. Distribution (Dist.)	Conservation Importance
49	<i>Lannea coromandelica</i>	Kalsh, Uthikalash, Odiyamaram	Tree	Moist deciduous forests and plains	All	Medicine
50	<i>Lawsonia inermis L.</i>	MyLANchi - Henna plant	shrub	Grown as hedge plant	All	Medicine
51	<i>Madhuca longifolia (Koenig) J.F. Macbr.</i>	Iluppa -South Indian mahua	Tree	Moist deciduous forests - Riverine	WYD, MPM, PKD, IDK & PTA	Medicine, Star tree-Revathi
52	<i>Magnolia champaca (Michelia champaca)</i>	Swarnacham pakam-Golden champa	Tree	Evergreen forests and cultivated in plains	All	Medicine
53	<i>Melia dubia</i>	Malavepu	Tree	Moist deciduous and semi-evergreen forests	Except KKD, KTM, ALP & PTA	Medicine
54	<i>Memecylon flavescens</i>		Tree	Evergreen and shola forests	WYD, MPM, PKD, IDK & KLM	Endangered, Endemic to Western Ghats
55	<i>Mesua ferrea L.</i>	Nagapoovu - Indian Rose chestnut	Tree	Evergreen forests	All	Medicine, Star tree-Ayilyam
56	<i>Mesua thwaitesii Planch. & Triana</i>	Kilinanku	Tree	Evergreen forests and sacred groves	WYD, KKD, PKD, IDK	Medicine
57	<i>Mimusops elengi L.</i>	Elangi -Bakul tree	Tree	Semi-evergreen / evergreen forests and homesteads	All	Medicine, Star tree-Anizham
58	<i>Morinda citrifolia L.</i>	Noni - Indian Mulberry	Tree	Open areas Also cultivated	All	Medicine
59	<i>Mussaenda frondosa l.</i>	Vellilathaali - Dhobi tree	shrub	Moist deciduous / semi-evergreen forests and plains	All	Medicine
60	<i>Myristica beddomei</i>	Chithirapoovu Kattujathi	Tree	Evergreen and semi-evergreen forests	Except KSD, KKD, ALP, KTM	Medicine

Sl. No.	Botanical Name	Local/ English Name	Habit	Habitat	Nat. Distribution (Dist.)	Conservation Importance
61	<i>Naringi crenulata</i>	Malanarakam	Tree	Semi-evergreen and moist deciduous forests and plains	All	Medicine
62	<i>Neolamarckia cadamba (Roxb.) Bosser</i>	Kadambu - Cadam	Tree	Along banks of rivers and streams in evergreen forests and plains	Except KSD	Medicine, Star tree-Chathayam
63	<i>Nyctanthes arbor-tristis L.</i>	Pavizhamalli -Night jasmine	shrub	Cultivated	All	Medicine, Ornamental
64	<i>Olea dioica</i>	Karivetti	Tree	Semi-evergreen and moist deciduous forests, also in the plains	All	Endemic to India, Medicine
65	<i>Oroxylum indicum</i>	Palakapayyan i	Tree	Moist deciduous forests and plains	All	Medicine
66	<i>Persea macrantha</i>	Uravu, Kulamavu	Tree	All types of forests and sacred groves	All	Medicine
67	<i>Piper nigrum L.</i>	Kurumulagu-Black pepper	Climber	Cultivated	All	Medicine
68	<i>Polyspora obtusa (Wall. ex Wight & Arn.) Niissalo & L.M.Choo</i>	Adangi, Kattukarana	Tree	Evergreen forests	Except KSD, ALP, KTM	Medicine, Endemic to Western Ghats
69	<i>Premna tomentosa</i>	Naithekkku	Tree	Dry deciduous forests	WYD, PKD, IDK	Medicine
70	<i>Prioria pinnata (Roxb. ex DC.) Breteler</i>	Churali, Ennappayin, Kiyavu	Tree	Evergreen forests	Except KSD, TSR, PTA, KTM	Endangered, Endemic to Southern Western Ghats, Medicine
71	<i>Prosopis juliflora (Sw.) DC.</i>	Vanni - Algarobo	Tree	Exotic Cultivated	KSD, PKD, IDK, EKM, ALP	Medicine, Star tree-Avittam
72	<i>Pterocarpus</i>	Venga	Tree	Moist and	All	Medicine

Sl. No.	Botanical Name	Local/ English Name	Habit	Habitat	Nat. Distribution (Dist.)	Conservation Importance
	<i>marsupium</i>			dry deciduous forests and plains		
73	<i>Pterocarpus santalinus</i>	Rakthachandanam	Tree	Native of Peninsular India-Cultivated	MPM, PKD, TSR, EKM	Medicine
74	<i>Pterospermum reticulatum</i>	Malayuram	Tree	Evergreen and semi-evergreen forests	WYD, MPM, PKD, TSR, IDK, KLM, TVM	Endemic to Southern Western Ghats, Medicine
75	<i>Putranjiva roxburghii</i> Wall.	Puthranjeevi -Official Drypetes	Tree	Deciduous forests & sacred groves	MPM, PKD, TSR, IDK ALP	Medicine
76	<i>Quassia indica</i>	Karinjotta	Tree	Along backwaters and moist deciduous forests	Except PKD, IDK and PTA	Medicine
77	<i>Saccharum officinarum</i> L.	Karimbu - Sugar cane	shrub	Cultivated	All	Medicine, Food
78	<i>Salix tetrasperma</i> Roxb.	Vanchimararam	Tree	long riverbanks in semi-evergreen forests	KNR, WYD, PKD & IDK	Medicine, Star tree-Pooradam
79	<i>Schleichera oleosa</i> (Lour.) Oken	Poovam - Ceylon oak	Tree	Semi-evergreen and moist deciduous forests and plains/sacred groves	All	Medicine
80	<i>Senegalia catechu</i> (L.f.) P.J.H.Hurter & Mabb	Karingali - Black catechu	Tree	Dry deciduous forests - cultivated in plains	All	Medicine, Star tree-Makayiram
81	<i>Spondias pinnata</i> (L.f.) Kurz	Ambazham - Wild mango	Tree	Moist deciduous and semi-evergreen forests and plains	All	Medicine, Food, Star tree-Atham
82	<i>Sterculia guttata</i>	Aanathondi, Kithondi	Tree	Semi-evergreen	All	Medicine

Sl. No.	Botanical Name	Local/ English Name	Habit	Habitat	Nat. Distribution (Dist.)	Conservation Importance
		Narukorumban		and moist deciduous forests and plains		
83	<i>Sterculia urens</i>	Theethondi, anathondi	Tree	Moist and dry deciduous forests	KKD, MPM, PKD, TSR, IDK & TVM	Medicine
84	<i>Stereospermum colais</i>	Poopathiri	Tree	Moist deciduous and semi-evergreen forests	Except KKD	Medicine
85	<i>Streblus asper</i> Lour.	Paravamaram - Siamese rough bush	Tree	Moist and dry deciduous forests, also in the plains	All	Medicine
86	<i>Symplocos cochinchinensis</i> ssp. <i>Laurina</i>	Kamblivetti	Tree	Evergreen, semi-evergreen and shola forests	All	Medicine
87	<i>Syzygium travancoricum</i>	Poriyal, Vathamkollimaram	Tree	Semi-evergreen and mangrove forests	TSR, EKM, ALP, PTA, KLM, TVM	Medicine, Critically endangered, Endemic to Southern Western Ghats
88	<i>Talipariti tiliaceum</i> (L.) Fryxell	Veliparuthi-Yellow mallow	Tree	River banks=cultivated in plains	All	Medicine
89	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	Neermarathu /pulimatti - Arjun tree	Tree	Dry and moist deciduous forests	KSD, KNR, WYD, PKD & IDK	Medicine, Star tree-Chothi
90	<i>Toona ciliata</i> Roem.	Chandanave mbu -Toon tree	Tree	Semi-evergreen and evergreen forests	All	Medicine
91	<i>Vateria indica</i> L	Vellappayin - White dammer	Tree	Evergreen and semi-evergreen forests and plains/Sacred groves	All	Endemic to Western Ghats, Medicine, Star tree-Moolam

Sl. No.	Botanical Name	Local/ English Name	Habit	Habitat	Nat. Distribution (Dist.)	Conservation Importance
92	<i>Vateria macrocarpa</i>	Valiyavellappayin Perumpayin	Tree	Evergreen and semi-evergreen forests	PKD, EKM	Critically endangered, Endemic to Southern Western Ghats
93	<i>Vitex negundo L.</i>	Nochi	Shrub	Grown as hedge plant	All	Medicine
94	<i>Woodfordia fruticosa (L.) Kurz</i>	Thathiri - Fire flame bush	Tree	Cultivated	All	Medicine



Students and Mentor Teachers get intensively trained on a holistic Green Audit



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2.2 Energy Audit

'Energy Audit' has great influence in bringing down the carbon footprint of an institution, and also in identifying the fastest routes to carbon neutrality. Thus, it helps in raising an institution's green status. Students can practice energy management even at home through simple energy audit exercises learnt from the conservation activities at the college. Energy savings is easy to achieve. The results in terms of performance, and the profits, are immediately visible too. It is the first initiative for saving on energy, and so is a very useful activity for any institution. Owners find it useful as it helps them save money on energy cost. But, in our country, people do not pay much attention to the simple approaches that can save volumes of energy, even without spending a Rupee on it.

NSS College in Nemmara, Palakkad is currently paying an average cost of Rs. 9.36 on every unit (kWh) of electricity it uses. Students can work out a plan to bring down this cost through simple analysis of energy data. Getting the same or more of work done with less energy through carefully chosen energy saving measures is called 'energy management'. To minimize the losses and wastes within the campus, staff and students should know where and when, and how and how much energy is used in getting the needed 'energy services'. We use energy to obtain several 'services'. Aiming at a better energy efficiency scenario (Reduce energy used for any work, or get more from each unit of energy used as the objective of energy audit.

The major sources of carbon emissions in an educational institution are the use of electricity and other forms of energy, transportation, and wastes linked to food preparation and consumption, as well as other routine actions that we do carelessly. As a part of the current year's green audit, the data pertaining to electricity, transportation, water, and wastes are closely monitored to see whether the NSS College students in Nemmara are 'conservation conscious' or not.

In a campus like NSS College, Nemmara in Kerala, the campus occupants have to depend on different sources of energy – such as electricity, petroleum gas, diesel, petrol, and firewood. Minimising the total expenses without adding ecological damages will be the objective of the management. For getting 'energy services' that are unavoidable for the staff and students to live and learn within the campus, as well as for the 'day scholars' attending the college, a lot of energy is to be used, but a part of that energy will definitely go waste. Most of the time, the major components of carbon footprint [which indicates its ecological performance] will be from the energy related activities or from transportation. So, we must look at these sectors very carefully.

An 'Investment Grade' energy audit, if conducted for the College campus, can present a picture of actions required to control 'energy costs,' and the approach needed for ensuring 'energy security'. The campus population is found to be as follows:

Students (boys and girls): 1,339; Teaching Staff: 75; Non-teaching staff: 19; casual guests/visitors: 17. Total: 1,450. Per capita Electricity use on audit is seen to be a bit too modest at 13.9 unit (see Table 2.2.1.2).

Month	Electricity use in kWh	Energy Charges Paid Rs.
June 2022	1,085	19,599
July 2022	1,983	16,902
August 2022	1,560	14,229
September 2022	1,535	13,815
October 2022	1,361	12,773
November 2022	1,996	17,418
December 2022	Door lock	14,427
January 2023	3,568	15,868
February 2023	1,612	14,614
March 2023	1,952	17,272
April 2023	1,732	15,643
May 2023	1,543	13,887
Total for 2022-'23	19,927	1,86,447
Average monthly	1660	15,537

Average per unit (kWh) cost = Rs. 9.36

Table 2.2.1.2: Monthly Electricity Consumption and Cost

The per capita annual electricity consumption is:
 $19,927/1433 = 13.9$ kWh (units). This is very modest.

There are very economic ways of achieving an overall higher efficiency through reducing energy consumption, and thereby carbon footprint due to electricity consumption.

Observations and Suggestions

1. The College does not monitor the energy use pattern in different activity zones or for exclusive uses like energy used for water pumping, water purification, hostel, laundry, etc. Half yearly evaluation of such sub-sectors will help in upgrading the strategy of energy conservation.
2. The extent of power failures and how often (reliability) are to be recorded regularly in a separate register.

2.2.1. Energy Efficiency Improvement

Improving energy efficiency is an important task before any institution, when the country is working hard towards attaining Carbon Neutrality by 2070. Kerala State has targeted Carbon Neutrality by 2050. The most attractive opportunity in the path of greening through energy management is the avoidance of incandescent bulbs and replacement of ordinary fluorescent tubes with LED lamps and tubes. The institution has not reported any plan of action for its buildings to install energy efficient equipment, especially at the earliest opportunity of replacing non-functional devices.

The College may therefore, draw up a plan for the 'Survey of all electrical installations in the campus, to be done by student green guardians and list out the number and quantum of energy and money that can be saved through retrofitting more efficient devices in the circuit.

Major reduction in GHG gases emitted and the Carbon Footprint can arise from electrical energy savings in the use of fans. If 100 conventional single-phase AC fans of 1200 mm sweep are replaced with the brushless d. c. (BLDC) fans [26 W], the power saving is at least 50 watts/fan, and assuming an average 6 hr/day of use, and 250 working days in a year, the energy cost savings (average net cost is Rs. 9.36 per kWh), will be (50 W x 6 h x 250 d) divided by 1000 and multiplied by Rs. 9.36. That is Rs. 700/fan) in a year. For 100 fans, savings is close to Rs. 70,000. Such a fan costs Rs. 3,000 if purchased in bulk - roughly 1000 rupee more than a conventional ac fan.

For initial installations, BLDC is therefore a better choice, because the extra investment is fully repaid in one year. This fan has certainly a life span of 20 – 25 years. For the next 24 years, savings in 'current charge' due to one BLDC fan will be around Rs. 17,000. In addition, these fans have remote control facilities to smoothly vary the speed and save more energy. For replacement as well, full investment of even Rs. 3,000-3,600/fan will be repaid in 3 years.

Standby Power Generator Log & Interruptions Record

Generator Capacity : kVA
Diesel/Fuel Cons. per hr :
Total hours run/year :

Date	Power Supply Time failed	Power Supply Time restored	Gen start	Gen stop	Reason if known

According to the 'Life Cycle Cost' approach, the cost comparison is like this:

For homes: *Initial cost + Op cost (electricity) = Total LCC*

(60 W fan, 8 hr/day, 20 year use, Rs 5/kWh): $60W \times 8h \times 365d \times 5 / 1000$

Ordinary AC fan Life cycle cost = 2,000 + 17,520 = Rs. 19,520

BLDC fan Life cycle cost = 3,000 + 7,592 = Rs. 10,592

(26 W, 8 hr/day, 20 year, Rs 5/kWh)

With Fluorescent tubes replaced with LED tubes, the savings are still more attractive. It shows where the profits and carbon savings are lying hidden. LED tubes of 18 or 20 W are available now for Rs. 220-250. Energy use on them is just half.

Observations and suggestions (for improvement of energy use pattern):

1. In the case of major equipment, the strategy of physical isolation – i.e., removing the plugs from the plug base (socket) – when not in use – may be adopted, and this should be made known to the operators and other staff, through stickers on or near such equipment in the labs and workplaces. This will help in improving safety to the users and the equipment, and also in reducing the 'Phantom load' (Consumption of a small amount of energy in the 'switched off' condition).
2. A Maintenance schedule for the switchboards and distribution boards should be prepared, and exhibited for all those required to follow them without fail.
3. Arrange to keep Log Books for recording energy consumption, extent of power failures, and running of standby generator, etc. These shall be periodically inspected by a designated member of teaching staff.
4. Install own Energy Meters for sub-units (different units, hostels, canteen, auditorium, laboratories, gym, etc.) for monitoring and managing the monthly energy consumption in those areas.
5. Every month the electricity bill amounts should be compared with that of previous month as well as with the same month in the previous year, and if major difference is noted, the likely reason for that should be found out. Major differences should be investigated.
6. A small group of students can be trained in a half-day workshop to assemble LED bulbs and tubes from components and those could be used in the college. This will be cheaper. In addition, if they fail, students can repair them easily.

2.2.2: Renewable Energy Use Audit

Global Warming is now the “Hottest Problem” to solve on this Planet Earth. The excessive warming of the globe was and is, no doubt, on account of the trapped greenhouse gases in our atmosphere. The major portion of these gases, to the extent of 70% plus, is due to CO₂ owing to the increased use of fossil fuels for energy generation, for motive power, lighting, and for industrial and commercial uses. Therefore, global warming can only be halted through reduced use of energy from carbonaceous fossil fuels such as coal, oil, and natural gas. Right in 2022, more than 80% of electricity that Kerala state is using came ultimately from fossil fuel power stations from States outside of Kerala. It is possible to improve our welfare using less energy, at the same time sticking on to increased energy efficiency, and depending on energy through non-fossil, or renewable sources such as wind, sunshine, water, biomass, etc.

In NSS College, Nemmara, biogas plant technology is yet to be adopted. College Management may plan to introduce solar photovoltaic (SPV) power to offset the entire carbon footprints, and to bring down the payable electricity charges to almost ‘nil’. If properly planned, it is possible also to raise the energy security level in the campus. It can also eliminate the higher level of CO₂ emissions from the fossil fuel based 25 kVA standby generator.

Other Fuels Used: 1. LPG

No. and type of LPG Cylinders used during the year in different place							
(19.0 kg Cylinder) Canteen		(19.0 kg Cylinder) Hostel+ Canteen		(14.2 kg Cylinder) Laboratory		(specify) Other places	
Commercial	Domestic	Commercial	Domestic	Commercial	Domestic	Commercial	Domestic
80	-	-	-	6	-	-	-

2. Wood

Wood used/year in different places					
Canteen for cooking	kg	Hostel For cooking	kg	(specify) Training Centre	kg
Nil		Nil		Nil	

3. Diesel

Used/year in different places					
Standby Generator Place/Purpose	Litre	(Hospital; Lab) Place/Purpose	Litre	(specify) Place/Purpose	Litre
25 kVA	1,200		litre	--	

4. Biogas

Biogas used/day in different places					
Canteen for Cooking	Cum	Hostel For Cooking	Cum	Heating Water Place/Purpose	Hours/ Cum
-Nil			m ³	--	

Table 2.2.2.3: Energy sourced from sources other than electricity

2.3 Water Audit

N S S College, Nemmara, Palakkad is a greener campus mainly by virtue of its forest like vegetation maintained within nearly one-third of its campus area of 17 acre. Average annual rainfall in Kerala is 3000 mm. Rainfall in Palakkad district is not uniform. The Silent Valley region receives an average annual rainfall of more than 7000 mm, while Attappady and Chittoor gets only a meagre 700 mm. The average annual maximum temperature can be 32.3°C, and the lower limit could be 23.4°C. Adequate water supply for drinking, personal use, gardening, agriculture, and animal husbandry is what is to be ensured. But, many people including students in other parts of the State are unable to have a mental picture of the prospect of water shortage, even after several calamities have struck the State in the recent past. So, the focus of water audit in this campus in Palakkad is to find out whether adequate water is ensured for all activities. Also, to make sure that excessive pollution of water, or wastage of this precious commodity is not taking place.

Globally, institutions like World Resources Institute (WRI), WWF, The Alliance for Water Stewardship, The Nature Conservancy, Water Footprint Network (WFN), Carbon Disclosure Project (CDP), Ceres, and the Water Mandate Secretariat jointly conducted an in-depth study in 2013 to make the world understand the different stages of water shortage situations like, *Water Scarcity*, *Water Stress*, and *Water Risk*. They indicate a set of different situations which are clearly defined globally.

“**Water Scarcity**” refers to the volumetric lack of water supply. This is generally calculated as a ratio of human water consumption to the available water supply in a given area.

“**Water Stress**” refers to the ability to meet human and ecological demands for water. Compared to scarcity, “*water stress*” is a broader concept. It considers several physical aspects related to water resources, including water scarcity, but also water quality, environmental flows, and the accessibility of water.

“**Water Risk**” refers to the probability of a difficult water-related event. Water risk is felt differently by any sector of society and the organizations or families within them. Many water-related conditions, such as water scarcity, water pollution, poor governance, inadequate supply infrastructure, climate change, and others, create *risk* for many different sectors simultaneously.

NAAC’s aim is to ensure that such situations are avoided in the college premises at all times of the year. In ‘water stressed’ regions, ‘extra care’ is required for discouraging the methods of wasteful water use by the campus residents.

As of 2019, according to World Resources Institute (WRI), the extremely high water-stress experiencing countries are - in order of their ranking - Qatar, Israel, Lebanon, Iran, Jordan, Libya, Kuwait, Saudi Arabia, Eritrea, UAE, San Marino, Bahrain, India (13th), Pakistan, Turkmenistan, Oman, and Botswana. It is in these 17 nations that nearly 1.7 billion (22%) of the world's population reside, with the lion's share (1.37 billion or 18%) living in India. The weather experts assert that these 17 countries could experience heavy economic losses from climate-related water scarcity – up to 14% of GDP by 2050.

It is also estimated that 3.5 billion (out of 8 billion plus) people could experience water scarcity by 2025, which is just 2 years from now. Kerala too might be on the verge of serious problems beyond 2050.

The quantities involved in respect of NSS College, Nemmara, source-wise, are in Tables 2.3.1 to 2.3.5.

Table 2.3.1: Water Source/s (Indicate All)

No:	Source	Details
1	KWA/Municipal/Supply	Municipal
2	Own Well/s	
3	Pond/ Rain Water Harvest	
4	Other	

Table 2.3.2: Water Distribution Particulars

No.	Item	Details
1	Water pumps: Electric/Diesel	Electric 3HP
2	Overhead Tank/s, Capacity L	5 tanks total 14,000 L
3	Pumping hours	3 hours
4	Total water supplied daily	20,000 LPD
5	Other arrangements	Nil

Table 2.3.3: Water Consumption Particulars

Hand/Face/Floor/Utensil – Wash by Students and Staff

Place No.	Water Source	Total persons using	Average time/pax (minute)	Water flow/ min. Litre	Disposal to Drainage %	Disp Open Space %	Disp Treated Reused %	Disp Soak Pit %
1	Dept Taps	60	10	2	30%	20%	-	-
2	Common Taps	1300	1	2	20%	20	-	-
3	Water Coolers	1050	2	1	0%	0%	-	-

Table 2.3.4: Water Loss

Place of Leakage	Water Source	Water Loss/min (Litre)
Canteen	Sink	7:36 (250 ml)

Table 2.3.5: Water Consumption – Students’ Assessment

No.	Water Used for	Per Day Total
1	Toilet flushing	2,000 LPD
2	Cooking	500 LPD
3	Utensils Wash	400 LPD
4	Floor Wash	200 LPD
5	Gardening	1,500 LPD
6	Bathing/Personal cleaning	200 LPD
7	Other/	- LPD
8	Other/Occasional	- LPD
9	Loss thro’- tap leaks	- LPD
10	Loss thro’ pipe break	- LPD
	Total	4,800 LPD

Separate water meters are not provided in the college and canteen premises and therefore, the Student Green Guardians have collected data on water use by sample survey for the green audit. The various functionalities for which water is utilized is assessed by the student volunteers through sample measurements taken at user end - limited observation on water use by 10% of the student strength and extrapolated. The student survey results are off the mark. Therefore, this may be repeated during the next year, so that the results can come closer to the actual.

As per the actual data from the metering system the per capita water consumption of the college is 9.6 LPD, which is inadequate.

Observations and Suggestions:

Bureau of Indian Standards BIS 1172-1993 had set a per capita LPD of 100-150 for India, which in its 1998 revision has reduced it to 70 LPD per capita. The benchmark set for urban per capita water supply in India is 135 LPD. For a college with the lion share of students and staff in the campus during working hours only, the daily pc requirement can be much lower. But it should at least be close to 16 LPD. Audit finds that the arrangements on sourcing, purifying, recycling, and judicious use of water in NSS College need a detailed review.

2. 4. CGH – Clean, Green and Healthy – Audit

[Waste, Transportation, Health & Environmental Quality]

The 38-acre campus of NSS College at Nemmara in Palakkad district had at the time of its inception paid adequate attention to develop it as a greener, serene, and resource conserving environment. A healthy environment always help in having good bodily health and sound mental health, as well as sharpness in thinking.

The health of Planet Earth can only be ensured through a ‘Clean, Green, and Healthy’ way of life by its occupiers. Animals do not attempt to change the environment; rather they conform to it. It is the duty of human beings to respect the laws of nature and try to lead a way of life very close to Nature. The Nature as we understand is 4.5 billion years old, and the continued good health of Nature is very crucial for our sustenance. The future citizens are, therefore, not to deviate too far from Nature’s “limits of tolerance”.

The present-day lifestyles create problems of wastes, and add pollution to the environment through various ways. The CGH audit is to ensure that the ‘learning environment’ for the students of the audited campus is of the right type, healthy, and in other words ‘Green’.

2.4.1 Waste Audit

As a higher education institution operating in Kerala, NSS College, Nemmara is to dispose of its wastes as is being done in every other public institution. The table below lists the origins of wastes in the occupied areas of the college campus.

There are differences in quantity of wastes generated between workdays and holidays, as well as between seasons. Most of the population are in the campus only during daytime and that too on working days – max. of 250d.

Table 2.4.1.1: Garbage Bins Placed

Hostel Name/ Area	Number of students	Number of Bathrooms + Toilets	Number of Floors	Number of Rooms	No. of garbage bins/floor	No. of garbage bins per building
Main Building	800	12	2	24	4	8
Main Building	600	2	2	10	2	2
Total	1400	14	4	34	8	10

An average figure of wastes per person per day for college activity is however worked out by observing students' activities through a sample survey for a week by the student volunteers, and inspecting the disposal area, quantifying the measured wastes, and then extrapolating for the whole campus.

Table 2.4.1.2: Waste Generation Data (Based on Sample Survey)

Sl. No.	Name of Student	Hand/face /utensil wash seconds/day	Degradable Waste generated (g)			Non-Degradable Waste generated (g)	
			Food	Paper	Others	Approx.Qty (g/day)	Main Ingredient
1	Abhinand	600s	1500	800	-	100	Plastic
2	Abin R	850s	14500	750	-	75	Plastic
3	Ahisha V	745s	16500	200	-	50	Plastic
4	Vishnumaya	800s	14000	600	-	60	Plastic
5	Meera S	345s	13500	550	-	55	Plastic
6	Sukarna	450s	12750	480	-	30	Plastic
7	Vishal D	890s	14500	750	-	75	Plastic
8	Nidha	900s	10500	800	-	60	Plastic
9	Sujai S	850s	11750	675	-	75	Plastic
10	Sindhumol	680s	12680	800	-	80	Plastic

Table 2.4.1.1: Waste Materials & Disposal Mode

Sl. No.	Type of Waste Practice	Qty. kg/day	Type of Disposal	Remarks
1.	Food Waste by students & Staff	10	Used as fertilizer	-
2.	Food Waste: Canteen + Hostel	5	"	-
3.	Paper Waste by Students & Staff College	0.5	"	-
4.	Paper Waste Bulk: Canteen + Hostel	0.5	"	-
5.	Plastic Waste - Individual	0.001	Panchayat	To Recycling
6.	Plastic Waste - Bulk: Canteen+ Hostel+ Office	0.01	"	"
7.	Glass & other utensils: Canteen+ Hostel+ Office	0.2	"	"
8.	Electronic Waste: Canteen+ Office+ Laboratories	0.5	"	"

Table 2.4.1.2: Electronic Waste Bulk Generation Materials & Disposal
Specify area like Lab/Hostel/Canteen etc. in kilo gram

Place	Total Gen/day kg	Major Items	← Waste Disposal ←				
			Disposal through Local % Body	Disp. in public area %	Disp. in Land fill %	Burn %	Re-cycle/reuse %
Lab	0.01	Computer Parts	100%	0	0	0	0

Table 2.4.1.3: Stationery Used and Disposed

No.	Item-Material	Unit	Quantity
1	Paper A4, 80 gsm sheets	No.	40
2	File pad	No.	0.5
3	File Cover	No.	0.5
4	Paper Cups	No.	-
5	Paper Plates	No.	-
6	Other Paper Items		-
7	Printer Cartridge	No.	1

Suggestions & Recommendations

The data regarding wastes are not reliable enough. Due to COVID threats, the survey also appeared to give indications which are differing from standard utilization rate in other institutions.

There are no ready, up to date data available on these aspects presented to the audit for verification. The College may maintain registers for ready reference and review, so that material conservation can be effected through planning to reach intended bench marks.

2.4.2 Transportation Audit

For Colleges, reducing carbon footprint is a difficult task, as transportation and energy use related share of it will be the most prominent. Travel of students and employees to and from the campus has to be inexpensive and as comfortable as possible, for which public transport facilities like train and bus should be easily accessible. In the case of NSS College, Nemmara, buses are the most prominent option for daily commutation, since train timings are not in sync with college timing. The data on the number of people using public and personal transport are collected by the student volunteers through a survey. Rest of the students and staff, other than scooter and car owning persons, use public transport system for daily commutation.

:

Table 2.4.2.1: Institution Vehicles Operated
Educational Institution Vehicles Operated during 2022-23

No.	Average No. of Students per bus trip	Total distance travelled during the Year (km)	Fuel Consumed (Litre)
Bus:	-	-	Diesel 0 L
Car:	Official travels and Emergency	100 km	Petrol 10 L

Table 2.4.2.2: Vehicle Use Pattern (Staff & Students)

No.	Type of Vehicle used	Quantity	Details
1	Motor bike/scooter (single, shared) Per day a. No. of Motor bike/scooter b. No. of Students c. Total km travelled per day	25 40 240	single/shared km/person.
2	Auto Rickshaw a. No. of auto Rickshaws used b. No. of Students c. Total km travelled/day (to and fro)	4 18 35	Single/shared km x person
3	Own Car (Single, shared) a. No. of Cars b. No. of Staff & Students c. Total km travelled/day (to and fro)	2single;6shared 22 60	Single/Shared km x person
4	Shared Taxi/Car a. No. of Taxi Car b. No. of students c. Total km travelled/day (To and fro)	- - -	Single/Shared km/taxi
5	Private Van/Minibus/Bus a. No. of Vans/Mini bus used b. No. of Students & Staff using c. Total km travelled/day (to and fro)	- - -	km/vehicle
6	Public Transportation (Bus & Train) a. No. of Students, Staff b. Total km travelled by all persons/day	1200 800	km
7	Cycling to College a. No. of Students, Staff b. Average km travelled by person/day	12 65	Km
8	Walking to College a. No. of Students, Staff b. Average km travelled by person/day	85 170	km

Table 2.4.2.3: Survey of Students/Staff coming in Own/Hired Vehicle

Type of Vehicle: (Motor bike/scooter, Auto Rickshaw, Own Car (single, shared), Shared Taxi Car, Private Van/Mini Bus) – Use separate sheets for each type of vehicles

Reg. No. of Vehicle	No. of students/staff coming in the vehicle	Distance travelled/ day (km) to and fro
Car/own:		
KL 70 F 2222	1	16
KL 03 AE 4800	1	24
KL 01 AR 5700	4	48
Scooters:		
KL 70 B 4029	1	8
KL 70 G 2502	2	12
KL 49 B 2743	1	7
KL 70 F 4330	1	11
KL 51- 5555	1	45
KL 70 E 9166	2	7
KL 49 D 7460	2	8
KL 09 AU 5681	2	5
KL 49 N 8878	2	7
KL 01 CB 2748	1	8
KL 48 C 8187	1	7
KL 70 C 6957	1	7
KL 42 D 5584	1	9
KL 70 C 9139	2	9
KL 70 C 6957	1	11
KL 49 J 7448	2	10
KL 70 - 8008	1	7
KL 49 J 7385	1	6
KL 70 G 9932	2	6
KL 70 D 548	1	6
KL 09 AW 7190	1	5.5
KL 70 E 7995	1	7
KL 49 J 8559	1	8
KL 49 E 3150	1	6
Private Van:		
KL 08 BL 0124	20	60
Total	58	370.5

Table 2.4.2.4: Survey Students/Staff Using Public Transportation
Conduct survey in about 10% Student/Staff

Name. of students/staff	Distance travelled/ day (km) to and fro
Salini S	60
Rekha P S	70
Shilpa S	65
Manikandan	60
Nandhana Das	8
Suvarna G	16
Anoop R	24
Abhishek S	40
Akhila B	16
Jishnu P	32
Nitheesh S	17
Ragesh R	12
Subhisha M	18
Sahra M	22
Shahin S	26
Vidhun Kumar N	34
Vishnupriya A	41
Varsha V	26
Anagha P	84
Total	671

Table 2.4.2.5: Summary of Transportation Data

For assessing the carbon footprint due to transportation for the functioning of the College, the following specific details were aggregated from transportation data.

Sl. No.	Details: Type	No. of Vehicles	No. of Students/staff	Total km Daily run to & fro
1.	Motor bike/Scooter (Single/Shared)	25		2,620
2.	Auto Rickshaws used	-	-	-
3.	Own Car (Single/Shared)	4	8	180
4.	Taxi Car (Shared)	-	-	-
5.	Private Van/ Mini Bus	1	20	60
6.	Public Transportation/Bus	50	200	
7.	Cycling to College	22	22	60
8.	Walking to College		685	2,170
7.	Cycling to College	22	22	60
8.	Walking to College		685	2,170

2.4.3. Health Audit

Ensuring a healthy environment for learning to the students is an acknowledged responsibility of all higher education institutions. The purpose of greening of collegecampuses is to ensure that the students are able to live and learn in as rich a healthy environment as possible for every student to be pampered with offerings to develop youthful physical and intellectual capabilities to the full.

The method adopted by NGGFn for assessing the physical well-being of the educational institution in Green Auditing is as follows:

1. Examine the prevalence of major 'sick leave' cases, if there are any;
2. Examine the first aid and medical facilities available for resident students and staff, as well as for others during working hours;
3. Evaluate the atmospheric quality for adequacy, drainage systems for fast evacuation of liquids, and the extent of land pollution, if any in the campus; and
4. Assess the active involvement and achievements of students in arts, sports and games, especially in inter-collegiate and inter-university contests - as these are indications of their healthy mind and body.

Observations on these aspects in respect of NSS College, Nemmara for 2022-'23 are not offered, as adequate data, photographs, or reports were not readily available for the audit.

2.4.4 Audit on Societal Commitment, Outreach & Promoting Green

The students in colleges, especially undergoing degree level classes should be alert on problems arising in the society, those which adversely affect our immediate environment, and also learn to chalk out programmes and projects for solving the problems through the sustainable development route. In almost every country, activities related to economic development is found to be contributing to large scale decline in species diversity. Experts point out that - in a 'not too distant' future - the very survival of our planet Earth is going to be endangered.

A committee similar to IPCC on Climate Change, under the name "Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services" (IPBES) had its 7th session in Paris in 2018 with 132 nations attending, and the findings of it in its 1,500-page report is more frightening than the IPCC Reports and its dire warnings.

IPBES studied 15,000 research papers and government reports that have come out during the past 50 years on the biodiversity status.

The report has concluded that the global biomass with mammals have declined 82% over this period (rapid decline from 1970). Further, the natural ecosystems have declined by 47%, and the species threatened with extinction have reached 25%. 145 experts and 310 content authors from 50 countries had a 3-years' study on these aspects before coming out with this report.

In India, we have always believed in bringing out the best from our college students through social service volunteering, such as thro' National Service Scheme (NSS) units. The IPBES Report (2018) actually underlines the focus of UGC and NAAC on assessing how best the higher education institutions are in moulding the adolescent population into planners and leaders who would reverse the trend of the suicidal slide towards destruction of our living planet. NSS College, Nemmara, being an old and established higher education centre, such links are already established and operated smoothly. Details were not available to the audit, and hence no specific suggestions are offered. The College may in the subsequent year draw up a plan to expand societal interactions and outreach as a major element of greening.

3. Audit on Accessibility and Gender Justice

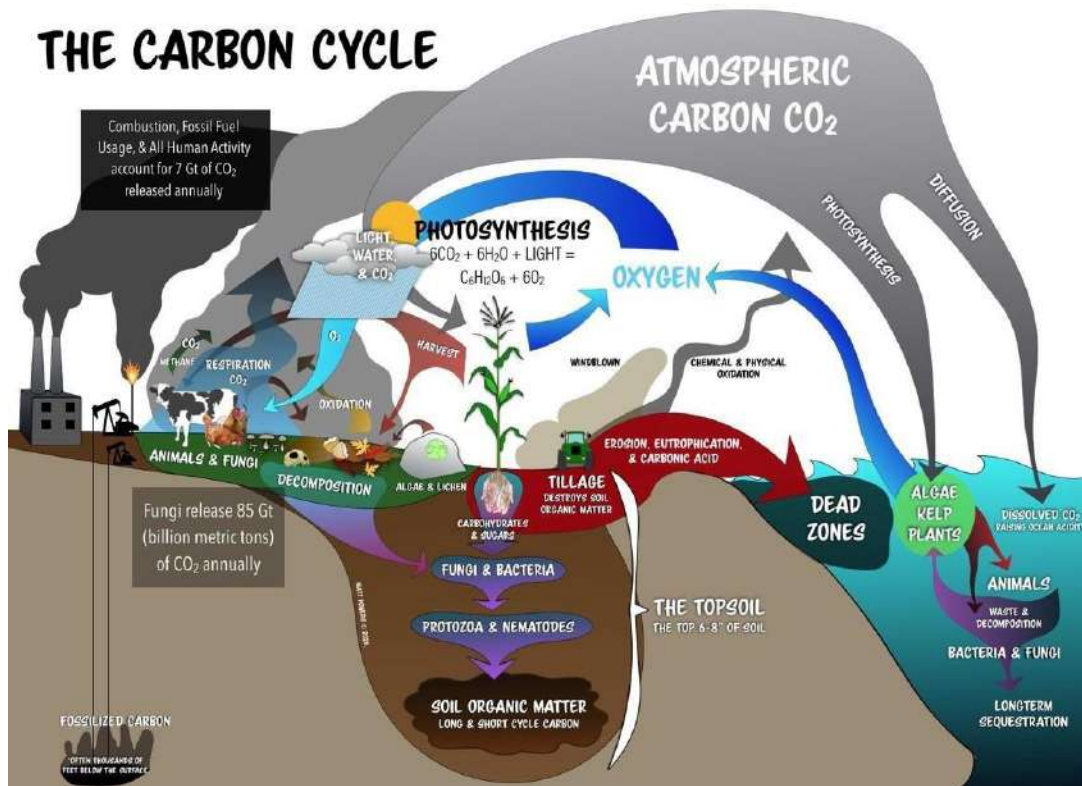
At NSS College, currently there are 8 differently-able students. No further details are available to the Green Audit team on Divyang-jans. The College is advised to review preparedness for accessibility and inclusive education of the differently able students or employees, like the needs for independently navigating the buildings and campus facilities.

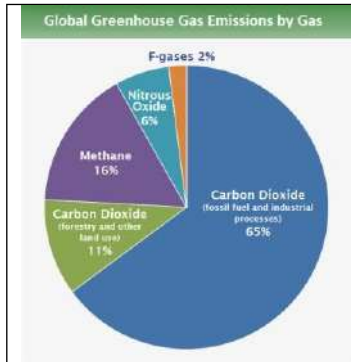
4. Carbon Footprint

Carbon Footprint is a measure of the total greenhouse- gases' emission released into the atmosphere. This may result from either individual, organizational, or community based human activities. An acceptable definition is: *Carbon Footprint is the total amount of greenhouse gases produced directly and indirectly for supporting human activities, usually expressed in equivalent tons of Carbon dioxide (CO₂).*

The diagram above is due to Matt Powers, a famous author and teacher. Matt says: "This is the carbon cycle, including oxygen and photosynthesis. Windmills or solar panels cannot solve the 'brokenness' of these loops. We need combined action to heal our planet, and keep it livable for humans." Matt continues in a recently published book titled 'Regenerative Soils': "We come to understand 'deep down in our hearts and guts' that we are part of nature; not above it, nor ruling over it – just part of it."

"Our earth operates in cycles and feedback loops. We need to slow down, observe and make wise decisions about energy, storage, and creating surpluses." The whole world knows that Carbon is an essential element. We cannot go without it. Yet, there is a huge outcry on de-carbonizing. The essence of green auditing is finding answers from our environment.



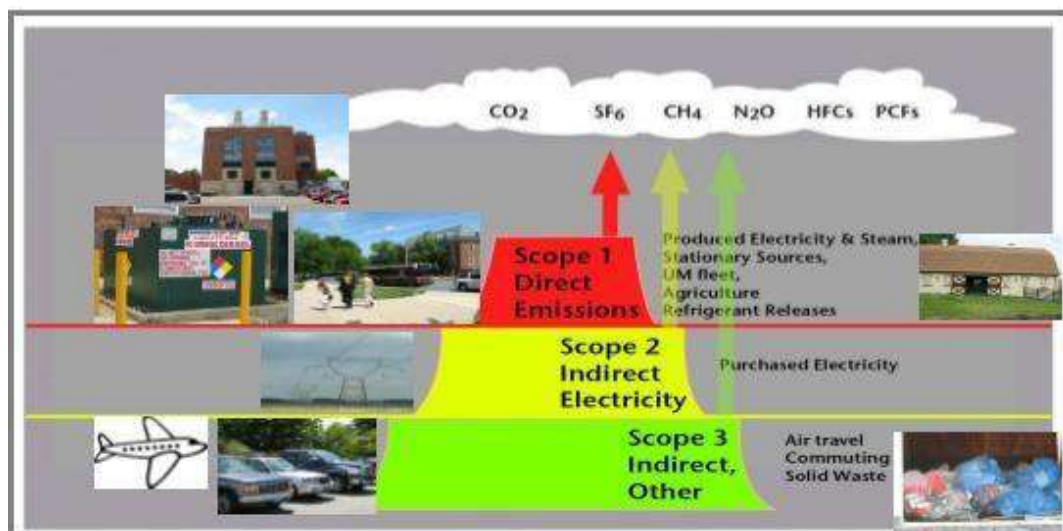


The most common greenhouse gases (GHGs) in our environment are carbon dioxide, water vapour, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the least harmful, but it is the most prominent GHG according to IPCC, comprising 76% or more of all GHG gases, globally. The release of CO₂ into the earth's environment through human activities is known as carbon emissions and its total impact is the 'carbon footprint' [IPCC 2014].

The ability of earth to meet the excessive demands on resources of its population has been increasing day by day. This brings about adverse ecological impacts, which can be quantified as 'Ecological Footprints'. But its computation is very complex and time consuming. The concept of 'Carbon Footprint' as a part of the 'Ecological Footprint' was put forward in 1990 by William E. Rees and Mathis Wackernagel.

Carbon Footprint (CF) by itself is not the complete measure of the damage to environment. The advantage of Carbon footprint approach is that it measures mainly the emissions of gases that contribute to climate change, and therefore can be more accurately assessed than the ecological footprints.

How emissions (Carbon Footprints) arise



Source: University of Maryland Study Report

There are popular software tools called 'CF calculator' for use by interested individuals and institutions for estimating the CF. Figures obtained from such tools are not very exact, but are good enough to have a comparison, or a picture of how large it is. This is more than sufficient to suggest as to how deep should the remedy be, for the damages inflicted.

If the purpose of knowing the carbon footprint is only to create awareness on the related environmental problems, such software available on the internet can be handy. But, to plan remedial actions, a little more detailed, item-wise assessment is required. The 'carbon footprint' assessment, as an idea, was popularized worldwide only in 2005 - by British Petroleum (BP) Company under one of its campaigns.

While the whole world believes now that CF is a simpler way than the EF to assess and look at the extent of damages to the environment that can happen, or is happening, Christopher Weber of Carnegie Mellon University is of opinion that the calculation of CF for many commonly used products is in effect a "complex job".

Take for example, the smart phones that are being used in almost all countries. The data required for calculating the carbon footprint of a smart phone will require the CF figures connected with its: production, shipment, technology used, and how long it is used every day, as well as on what all functions of the device are actually being utilized. Therefore, to accurately calculate the carbon footprint of a smart phone, we require too much time, energy, and resources. It is not worth the trouble and time to go for such detailed study, just to know the CF.

To calculate the CF of an institution, industry, product, event, or service, we should first appreciate the fact that it is a complex task, and the efforts to obtain the same should be commensurate with what we want to do with that result.

Life Cycle Assessment

One such tool for CF assessment, now considered meaningful, is the LCA (Life Cycle Assessment) approach, which has as its base "the entity's impact during its whole life period". The ISO (The International Organization for Standardization) has a standard for this in ISO 14040:2006 (with the framework for conducting an LCA study). Another method is through the Greenhouse Gas (GHG) Protocol and the set of standards it has for tracking GHG emissions.

The Carbon Footprint calculation of a college like NSS College, Nemmara, Palakkad, is to know whether or not the college activities are making excessive demands on the ecology of the campus and its surroundings, and then to attempt 'remediation' through possible 'reductions in consumption' as well as 'expansion of carbon sinks' such as the biodiversity. The College is at liberty to choose either to go for remediation to bring the compensation to the exactly required level, or even aim at 'excess' remediation if that doesn't cost heavily.

But, doing it either way and feeling relaxed that one has remedied it to the satisfactory level, is possible only after assessing the damages it is inflicting on its close environment in a practical manner.

The important stakeholders like students, staff, and the management can explore all means of reducing the 'consumption' that may result in higher emissions, increase the use of low-emission energy forms, employ the 4R or 'reduce-reuse- recycle-refuse' strategy for waste management, and expand the GHG absorbing and sequestering technologies and greenery – to achieve a little more than what is demanded as per the findings. That will help the campus to grow 'Greener' than a 'Green Campus'.

The team assessing the CF should know that very tedious procedures involving continuous monitoring throughout the year to obtain a precise measure of the damages to the environment is not warranted. This green audit by NGGF_n, therefore, is employing only empirical measures that quantify the ecological footprint to a reasonable accuracy, and suggest simple remediation measures within the reach of the institution, that would neutralize the impacts completely or to a substantial measure. Also, looks at the possibility of taking the positives present within reach, to levels a little higher than what is required. As the major contributors of damaging impacts are the higher number of stakeholders, their nature of consumption, and the transportation modes requiring fossil fuels, the approach for this Green Audit is to use empirical constants on the quantities arrived at for the major contributors. Remediation is to depend on expanding the available positive factors.

Creating awareness to the entire campus community on these and getting them to contribute voluntarily will be an effortless change in lifestyle, on which the institution as a whole can feel contented and be proud of.

Data Obtained from Component Audits

Component Audits in the foregoing Chapters 1 to 3 are the base elements for this Section. These component audit findings give us the data, like:

1. The area covering the higher education institution/college
2. The total number of persons (students, teachers, other members of staff, visitors like parents and guests) involved
3. The number of people resident in the campus
4. The type and number of vehicles normally used for transportation
5. The forms and quantity of energy used in the campus
6. The amount of consumed energy, water, food materials, & stationery
7. The quantity of wastes, including food waste and e-wastes
8. Amenities provided in the campus and their contribution to emissions

On the positive side:

1. The biodiversity in the campus & their potential to offset emissions
2. The 'carbon positive' (renewable) energy generation within the campus
3. The amount of recycling/reuse of resources
4. The type of waste management resorted to
5. Water harvesting, water management, and waste reduction approach

Assumptions:

The following assumptions based on well researched and globally accepted empirical procedures, are used for assessing the carbon footprint as well as for determining the remediation measures:

1. The coefficients taken are as per IPCC, International Energy Agency, India's BEE, or United Nations' FAO [in the case of food related ones] as well as from India specific studies by Research Institutions.
2. The carbon emitted by a car while consuming 1 litre of petrol is taken as 2.3 kg CO₂, and of diesel as 2.68 kg CO₂.
3. Average distance covered by a car per litre of petrol in cities at 10 km.
4. The 'km run' by a bus as 4 km/L of diesel in towns and cities.
5. For the 'per capita carbon footprint' calculation, a bus carry 50 passengers with the kilometrage as at assumption 4.
6. For an auto rickshaw, the fuel need is assumed at 1 litre of fuel capable of getting 16 km of running on petrol.
7. Two wheelers are expected to get 50 km/litre on Petrol.
8. Carbon absorption capacity of one full-grown tree as 6.8 kg CO₂.
9. Carbon absorption capacity of semi-grown trees as half of full grown.
10. Carbon absorption of bush plants as varying widely according to the species. Certain bushes absorb as high as 49,000 g CO₂ per plant, whereas some others absorb as low as 150 g CO₂ per plant. As a general guide, the per-plant carbon absorption is 200 g CO₂.
11. The absorption capacity of a 10-sq. ft. area of lawn is 1.0 g CO₂/day.
12. A person uses ~ 550 L of pure oxygen/day (Arbor Day Foundation).
13. Paper used is assumed to be of density 80 gsm (average).
14. Firewood is assumed to have <10-20% moisture before burning.
15. Contribution of events & festivals in the campus to CF is based on the no. of events, participating pax and extent of festivities with high emission levels.

Carbon Footprint Assessment Required:

The following activity related carbon footprints are to be assessed in Table –4.1 based on data available from component audits in previous chapters.

1. Carbon Footprint due to energy use
 - a) Electricity use including water pumping, water purification & water treatment.

-
- b) Use of Fossil fuels like Diesel, Petrol, LPG etc.
 - c) Use of Firewood.
2. Carbon Footprint due to production of Wastes
 - a) Food Waste.
 - b) Paper use & Paper waste.
 - c) Waste water.
 - d) Other wastes (e-wastes, hazardous wastes etc., if any).
 3. Carbon Footprint due to Transportation needs
 - a) Day scholars commuting between home and college.
 - b) Staff & Students – weekly/quarterly travel to home and back.
 - c) Use of Cars & Taxis by Staff, Parents, Management and others.
 - d) Auto rickshaws (3-wheelers) hired.
 - e) Bikes and Scooters (2 wheelers) – Students and Staff.
 4. Carbon Foot print due to Events and Festivals within the campus

Remediation Available and/or Created:

1. Due to increased use of renewable energy (RE)
 - a) Solar PV electricity
 - b) Solar Hot Water
 - c) Wind energy, Micro Hydro Power & Other
 - d) Biogas
 2. Due to energy efficiency improvement
 - a) Replacement of old tube lights
 - b) Replacement of incandescent bulbs & CFLs
 - c) Replacement of Fans/Pump Motors etc.
 - d) Up-grading of UPS network & Phantom load reduction, etc.
 3. Due to waste reduction, recycling and waste to energy projects
 - a) Waste Reduction
 - b) Recycling
 - c) Waste to Energy
 4. Due to innovations in transportation
 - a) Sharing of Vehicles
 - b) Adopting Means of low CF travel options
 - c) Others like introduction of electric vehicles/Solar autos, boats etc.
 5. Due to biologic means
 - a) Conservation of existing greenery
 - b) Tree plantation (new) & Biodiversity conservation
 - c) Gardening, including lawns and hedges
 6. Due to 'Outreach' for Promotion of Green Living
-

Carbon Footprint Calculation
for NSS College, Nemmara, Palakkad, 678 508 Kerala, for 2022-23

Sl. No:	Source	Rate	Quantity x Days/year	Total Quantity	Annual Eqvt. CO ₂
1.a	Electricity use	0.82 kgCO ₂ /kWh (India 2018)	1660 kWh/month	19,920 kWh	16.3 T CO ₂
1.b	Fossil fuel use	2.68 kgCO ₂ eq/kg 2.30 kgCO ₂ eq/L	--	1,200 L	2.7 T CO ₂
1.c	Firewood	1.65-1.8kgCO ₂ eq/kg	-		
2.a	Food waste	1.9 kgCO ₂ eq/kg	15 kgx250d	3,750 kg	7.1 T CO ₂
2.b	Paper waste	1.725kgCO ₂ eq/kg	1kgx250d	250 kg	0.4 T CO ₂
2.c	Water waste	0.298kgCO ₂ eq/kL			
2.d	Plastic/Other	6.0kgCO ₂ eq/kg	0.1 kgx250	25 kg	0.1 T CO ₂
3.a	Bus - students	2.68 kgCO ₂ eq/L	(800/12/4) x 250	4,150 L	11.1 T CO ₂
3.b	Staff, Stu/week	2.68 kgCO ₂ eq/L			--
3.c	Cars, Taxis, and College Car	2.30 kgCO ₂ eq/L	60x250/10	1,500 L	4.3 T CO ₂
3.d	Auto rickshaws	2.68 kgCO ₂ eq/L	35x250/30	292 L	0.7 T CO ₂
3.e	Two wheelers	2.30 kgCO ₂ eq/L	240/50x250 L	1200 L	2.8 T CO ₂
4	Events, Festivals	LS			15.0 T CO ₂
5	Construction	Lump Sum	--		--
	Total				60.5 T CO₂

*No. of activity days in 2022-23 reckoned as: 250 days

Table 4.1: Calculation of Carbon Footprint Source-wise

Remediation for Carbon Footprint
Of NSS College, Nemmara, Palakkad, 678 508 Kerala, for 2022- '23

	Source	Rate	Quantity x Days/year	Total Quantity	Annual Eqvt. CO ₂
1	1.a. Solar PV electricity 1.b. Solar Hot Water 1.c. Wind energy 1.d. Biogas 1.e. Micro Hydro Power, other		- - - -	- - - -	-- -- -- --
2	2.a. Replacing old tube lights 2.b. Replacing bulbs & CFLs 2.c. Replacing Fans, Motors 2.d. UPS Upgradation 2.e. Reduce Phantom load	0.82	20 LED Tubes x 40 W x 6h x 250	12,00 kWh	0.9 T CO ₂
3	3.a. Waste Reduction 3.b. Recycling 3.c. Waste to Energy	0.26 kgCO ₂ /kL	15 kL/day	4,500 kL	1.2 T CO ₂
4	4.a. Sharing of vehicles 4.b. Low footprint options 4.c. Electric/Solar vehicles				
5	5.a. Greenery forest retained 5.b. Tree planting, Biodiversity 5.c. Gardens, Lawns etc.	Nil 22kg/yr. 2200 kg	LS		5.0 T CO ₂
6	6. Walking & bicycle use	2.68 kg/L	235x250/4	1468 L	3.9 T CO ₂
7	7. Outreach activities	22 kg/yr	LS		9.0 T CO ₂
	Total				20.0 T CO₂

Table 4.2: Remediation for Carbon Footprints: available/created.

The International Organization for Standardization (ISO) also provides some general standards for

- o Greenhouse gas emissions at Organization level (ISO 14064 - 1) and
- o Greenhouse gas emissions at project level (ISO 14064 - 2)
- o Specifications to validate and verify relevant accountings are documented in (ISO 14064 - 3)

NSS College, Nemmara, Palakkad 678 508 Kerala
Carbon Footprint Analysis and Evaluation for 2022-23

The actual per capita carbon footprint of NSS College, Nemmara, Palakkad, Kerala is 42 kg (0.042 Ton) of CO₂ equivalent [60.5 Ton/1450] during the COVID disturbed year 2022-23. With an offset of 20 TCO₂ obtained through remedial actions, the net carbon footprint during 2022-'23 is thus [60.5 – 20] = 40.5 T CO₂ eq.

The effective CF is 40.5/1450 or 0.028T or 28 kg CO₂/capita [2022-23]

According to the Economic Survey of Govt. of India, the per capita emission for an Indian in 2022 is 1.91 Ton CO₂ eq. per annum. This is a 5% increase from 2021's 1.82 T. Global average is 4.7 Ton.

For the year 2022-23, for NSS College, Nemmara, Kerala, though the Carbon Footprint per capita at 0.028 T CO₂ equivalent is low (comparatively), this has not been as a result of greening efforts during the audit year. No records have been presented before the audit team indicating such activities other than training a team of students on green auditing and their field practice during the year. Further, the per capita energy use, and per capita water use are below normal. Yet, it can be seen that frugal ways are part of the institution's cultural fabric - thro' serious efforts on waste management, recycling, and less dependence on personal transportation, etc. that have taken roots in the minds of the stakeholders.

The remediation gap between the assessed footprint and the available remediation is 40.5 Ton CO₂ eq. On a closer look, the major contributors of carbon footprint are:

1. Use of purchased electricity (16.3 T of CO₂)
2. Transportation (11.1 T of CO₂), and
3. Wastes (7.6 of CO₂)

The College may seriously consider direct remediation options, in spite of the very low CF status seen. Renewable energy use can easily be introduced, which will help the institution achieve Net Zero. The solar PV can be deployed economically (fastest route too) to get to Net Zero.

The College maintains greenery through its near forest natural vegetation. Important recommendations are provided by the Audit for increasing the 'biodiversity' in the campus. Waste recycling and use as energy and manure are also suggested.

The database may be updated and digitized, made accessible for students as well to effectively plan 7 review greening activities every year, and move on.

5. Future Directions

The Internal Quality Assurance Cell of the educational institution can turn the observations and recommendations in this report into action points after an internal discussion according to the factors indicated here as guidelines. A SWOT analysis on the institution's greening initiative is carried out.

Strengths and Weaknesses:

- Human resources : Staff, Students, PTA, NGOs, Public
- Physical resources : Location, land, building, equipment
- Financial : Grants, projects funding, fees, and other sources
- Activities and processes : Green Protocol, programs, services rendered
- Past experiences : Learning tools, Reputation of the institution

Opportunities and Threats:

- Future trends : What is in the horizon, or what is expected shortly
- The economy : Own, local, national, or other
- Funding sources : Own, donors, governments, subsidies, and incentives
- Demographics : Change of players – students + staff joining & leaving
- Physical environment : Sensitivities related to locality, public & political
- Legislation : Change in government policies, rules & regulations

Points for Consideration:

The college management should be given a strategic plan for making the campus greener than before, and simultaneously for creating awareness among the students on the need for a determined local effort to bring down all the negatively weighing factors. For this,

- *Decide on the directions to proceed that will be most effective*
- *Assess possibilities and limitations for the intended change*
- *Identify barriers that will force for limiting the objectives*
- *Find out new solutions to the problems in sight*
- *Re-look at plans to navigate the students and staff to get the best results*

As both the internal and external environments are liable to change from time to time, it is necessary to review the scenario once again – just before implementing a project.

Future Directions and Search for New Opportunities are indicated in the chapters covering the component audits. The main thrust appears to be:

1. *To increase the remediation, invest in roof top solar PV (with attractive returns too)*
2. *Conduct a more detailed energy audit, water audit, and transportation audit*
3. *Prepare a detailed register on bio-diversity of the campus (both flora and fauna)*
4. *Increase the biodiversity*
5. *Strengthen College Database. Keep all required data entered on a weekly or monthly basis, in Customized Registers/Computer Folders, assisted by students*

SWOT Matrix
For a Greener NSS College, Nemmara

S	W
<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> ➤ NSS College community practices a Green Protocol and the newly admitted students are groomed to follow it ➤ Students and Staff help in having a litter-free campus ➤ Wastereduction is already in practice ➤ The College 'Club Green Guardians' is established ➤ Community links for outreach activities are present, like NSS 	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> ∞ Due to location in a hilly setting, positive factors get delayed for access ∞ Entire students are available only during working hours (day scholars), limiting student contributions ∞ More students and staff members are outside of life science streams limiting the chances of integrating greening as a part of curricular work
O	T
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none"> ❖ There is ample opportunity for expanding the use of renewable energy for reducing the carbon footprint gap ❖ There is still scope for improving energy efficiency in the campus ❖ Rainwater harvesting set up through scientific planning has potential to raise water availability ❖ Tree plantation with Biodiversity expansion is possible 	<p style="text-align: center;">Threats</p> <ul style="list-style-type: none"> ○ Continuous care and support from day scholars are difficult to ensure ○ Repeating the campaigns and training annually is necessary ○ Increase in the no. of students tends to boost the carbon footprint ○ Climate change impacts in Palakkad district is on the increase, posing added threats to the widening of greening efforts



Nature's Green Guardians Foundation
Green Audit – Biodiversity Audit

Compliance Statement for AY 2022-23
NSS College, Nemmara, Palakkad, 678 508, Kerala

Overall Objective	Main Objectives	Compliance Status
Ensure that an effective biodiversity protection plan is followed in the campus with the maintenance of all plants and animals living in and around the campus, and expanding the same even to the communities outside the campus in addition to working for capacity building to withstand Climate Change impacts.	<ol style="list-style-type: none">1. Ensure that there is a competent Biodiversity Expert from an external agency, who will provide guidance on Biodiversity and Resource conservation, and improve the ecology.2. Ensure that an Environment Protocol is adopted and followed by the entire campus community, adherence of which is reviewed, monitored, and targets reset annually.3. Ensure that frequent training and awareness programs are planned and carried out focusing on climate change resiliency.4. Ensure that every student and staff member commit to the lowering of carbon footprint of the institution through sustained greening measures.5. Ensure that Environment Audit is conducted annually, with participation of staff and students, and that recommendations are followed up.	<p>Ensured continuous guidance of experts from NGGFN, and CED</p> <p>Ensured [Vide 2022-23 Green Audit Report for the Green Protocol]</p> <p>Done during the Audit year. Committed to continue</p> <p>Staff and students are involved and continuing</p> <p>Annual Green Audit commitment ensured</p>

Prof. V K Damodaran

Ex-UNEP Expert

For NGGFN Audit Team, dated 30 November 2023



Nature's Green Guardians Foundation
Trivandrum 695 043 India

Biodiversity- Green Audit Certificate
NSS College, Nemmara, Palakkad, Kerala for 2022-23

This Green Audit including evaluation of Biodiversity conservation has been conducted for N S S College, Nemmara, Palakkad, 678 508, Kerala, in accordance with the International Standards for ISO 14000 family of standards set by ISO TC 207 and its sub-committees, and Biological Diversity Act, 2002 (Act No. 18 of 2003) of Government of India and other relevant mandates for promotion of sustainable living and education in a healthy environment.

In our opinion, the Institution has presented before the audit team true and up-to-date data on the various aspects of working of this higher education institution, and appropriate audit procedures have been completed for preparing this report. The assessments and recommendations are based on data presented before the team at the time of audit and subsequently as clarifications.

The audit methodology did combine physical inspection of the campus on several work days and holidays, with analytical reviews of relevant documents and activities, as well as interviews with the designated Staff and Students of the College.

This audit is conducted to ensure that a green lifestyle is followed and implemented in the campus across all academic and non-academic departments, as well as by the body of students undergoing studies in the College.

Green Audit 2022-'23 of NSS College, Nemmara, Palakkad has found that the institution's per capita carbon footprint for the year is 0.028 ton of CO₂ equivalent, a level well below the current 2022 national per capita average of 1.91 t CO₂, with **potential to develop early into a carbon neutral campus**. All efforts are taken to conserve, protect, and enrich the existing biodiversity and also to extend efforts through outreach, and further by implementing the Green Protocol, and having a commitment to continue its green practices to positively impact the society at large.

Prof. V K Damodaran

Ex-UNEP Expert

For NGGF Audit, dated 30 November 2023

I agree with the data presented in this report as true, and further express my willingness to implement the recommendations of this audit report after internal review, even if any or many of them are in excess of the relevant mandates.

Smt. Thulasi K A, Principal

NSS College, Nemmara, 678 508 Palakkad, Kerala

Date: 30 November 2023

Signature & Seal



Nature's Green Guardians Foundation

Green Audit – Energy Audit

Compliance Statement for AY 2022-23

NSS College, Nemmara, Palakkad, 678 508, Kerala

Overall Objective	Main Objectives	Compliance Status
Ensure that an effective energy management plan is followed in the campus with high degree of energy efficiency and increasing rate of utilization of renewable energy, as also help raise the Climate Change resiliency, which is periodically reviewed and implemented incessantly.	<ol style="list-style-type: none">1. Ensure that there is a competent Energy Management Expert from an external agency, who will provide guidance on Energy conservation and energy transition initiatives.2. Ensure that the Energy Conservation Strategy is reviewed annually, progress monitored and achievable and measurable targets set for the future course3. Ensure that a Policy on embracing green energy, energy efficiency, and wastes to energy is evolved, enforced, and reviewed regardless of it exceeding legal mandates.4. Ensure that every student and member of staff commits to the lowering of carbon footprint of the institution from all facets of energy use.5. Ensure that Energy Audit is conducted annually, with involvement of staff and students and action taken on all the recommendations of the linked external expert energy agency.	<p>Ensured continuous support and guidance from NGGF and Green Energy Forum, headed by an International Energy Expert with multidisciplinary expertise.</p> <p>[Ensured. Vide Section on Energy Efficiency and on Renewable Energy Use in the Green Audit Report of 2022- 23.]</p> <p>Ensured. Vide Green Protocol in Green Audit Report of 22-23.</p> <p>Ensured. Training program organized.</p> <p>Energy Audit conducted and actions for 2023-24 in planning stage.</p>

Prof. V K Damodaran

*Ex-UNIDO International Energy Consultant
For NGGF Dated 30 November 2023*



Nature's Green Guardians Foundation
Trivandrum 695 043 India

Energy Audit Certificate
NSS College, Nemmara, Palakkad, Kerala for 2022-23

Energy Audit for the period of academic year 2022- 23 has been conducted at NSS College, Nemmara, Palakkad 678 621, Kerala, in accordance with the International Standards for ISO 14000 family of standards set by ISO TC 207 and its Sub-committees, Bureau of Energy Efficiency Standards, and stipulations under the Energy Conservation Act 2021 of Government of India, and other relevant mandates for maintenance of sustainable and healthy environment for education in the campus.

In our opinion, the Institution has presented true and up-to-date data on relevant activities to the audit team, and appropriate audit procedures have been completed for issuing this Audit Certificate and the Compliance Statement. The recommendations are based on verified data presented as they existed at the time of audit.

The inspection methodology did combine physical inspection of the campus, with analytical reviews of relevant documents and activities, as well as interviews with the principal, and selected members of staff and students.

Audit findings indicate that, of the 60.5 T CO₂ of actual carbon footprint of the institution for the year, the contribution from direct use of electricity and firewood was only at 16.3 T CO₂. Transportation including public transport use (outside the campus) is at 11.1 T CO₂. Wastes contributed 7.6 T CO₂. Wastes to energy thro' biogas has potential to be developed as an eco-route to remediation. Effective awareness and training programs were conducted during the year, to make all stakeholders aware and to update on the need for individual efforts.

Prof. V K Damodaran

*Ex-UNIDO International Energy Expert
For NGGF Audit, dated 30 November 2023*

I agree with the data presented in this report, as true, and further express my willingness to implement the recommendations of this audit report after internal review, even if any or many of them are in excess of the relevant mandates.

Smt. Thulasi K A, Principal

NSS College, Nemmara, 678 508 Palakkad, Kerala

Date: 30 November 2023

Signature & Seal



Nature's Green Guardians Foundation
Green Audit – Environment Quality Audit
Compliance Statement for AY 2022 - 23
NSS College, Nemmara, Palakkad, 678 508, Kerala

<p>Ensure that an effective environmental protection plan is followed in the campus with the maintenance of highest level of air quality, and 3R policy on waste management - focusing on mitigation, adaptation and capacity building for Climate Change impacts resiliency, which is periodically reviewed and got implemented by all stakeholders.</p>	<ol style="list-style-type: none">1. Ensure that there is a competent Environment Expert from an external agency, who will provide guidance on Resource conservation, Waste management and Air and Water quality assurance.2. Ensure that an Environment Protocol is adopted and followed by the campus community, adherence of which is reviewed annually.3. Ensure that frequent training and awareness programs are chalked out and implemented, focusing on climate change resiliency, maintenance of air quality in the campus and students' living environment.4. Ensure that every student and member of staff commits to the lowering of carbon footprint of the institution from all facets of energy use, including for transportation and mobility needs.5. Ensure that Environment Audit is conducted annually, necessarily with involvement of staff and students, and action taken on all recommendations arising out of it.	<p>Ensured guidance from NGGFN and CED - having international environment, transportation, and energy management experts.</p> <p>Ensured. Green Protocol included in the Green Audit Report for the year.</p> <p>Ensured. Training given. Regular work experience also ensured.</p> <p>Commitment Ensured. Elaborate programs for environment quality assurance is planned.</p> <p>Ensured. Environmental Audit conducted and actions initiated for the next year. [Vide GA Report Ch. 5]</p>
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Prof. V K Damodaran

Ex-UNEP Expert

For NGGFN Audit Team, dated 30 November 2023



Nature's Green Guardians Foundation

Trivandrum 695 043 India

**Green Audit – Environment Quality Certificate
NSS College, Nemmara, Palakkad, Kerala for 2022-23**

This Green Audit including evaluation of Environmental Quality has been conducted for N S S College, Nemmara, Palakkad, 678 508, Kerala, in accordance with the International Standards for ISO 14000 family of standards set by ISO TC 207 and its sub-committees, and Biological Diversity Act, 2002 (Act No. 18 of 2003) of Government of India and other relevant mandates for promotion of sustainable living and education in a healthy environment

In our opinion, the Institution has presented true and up-to-date data on the various aspects of working of this education institution, and appropriate audit procedures have been completed by the audit team for issuing this Audit Certificate and Compliance Statement. The recommendations are based on verified data presented on the situation as they existed at the time of audit.

The audit methodology did combine physical inspection of the campus on several occasions, with analytical reviews of relevant documents and activities, as well as interviews with the principal, selected Staff members and Students of the College.

Audit findings indicate that, of the 60.5 T CO₂ of actual carbon footprint of the institution for the year, the contribution from Transportation and mobility including public transport use is at 11.1 T CO₂ – with negligible amount coming from the use of personal vehicles by staff and students, and that out of Wastes is at 7.6 T CO₂. The remedial activities contributed an overall relief of 20 T CO₂. Environmental Quality in the campus of 1433 population is Satisfactory.

Prof. V K Damodaran

*Ex-UNIDO International Energy Expert
For NGGFn Audit Team, dated 30 November 2023*

I agree with the data presented in this report, as true, and further express my willingness to implement the recommendations of this audit report after internal review, even if any or many of them are in excess of the relevant mandates.

Smt. Thulasi K A, Principal

NSS College, Nemmara, 678 508 Palakkad, Kerala

Date: 30 November 2023

Signature & Seal