SANTHIGIRI COLLEGE OF COMPUTER SCIENCES

VAZHITHALA, THODUPUZHA
685 583, KERALA

GREEN AUDIT REPORT 2021 – ’22

Nature’s Green Guardians Foundation
Trivandrum 695 043

Santhigiri College of Computer Sciences, Thodupuzha

Green Audit Report 2021-'22
Contents

Santhigiri College of Computer Sciences

Profile

Santhigiri College of Computer Sciences, at Vazhithala in Thodupuzha, the only 100% barrier free, inclusive higher education institution in Kerala was established with the approval of AICTE in 2002. The College is affiliated to MG University, Kottayam. Santhigiri College has a luminous profile having 60 years of transformation and expansion, starting as a PS Monastery in 1961. The Carmelites of Mary Immaculate (CMI) Congregation with Saint Kuriakose Elias Chavara as its founder has a vision of education stated as "*to become spiritually deep-rooted, morally upright, emotionally mature, intellectually erudite, efficient in communication skills, sublime in attitude, sober in behaviour, and active in social concern*". The CMI Fathers of Carmel Province, Muvattupuzha, Kerala have carved Santhigiri College to realise this vision on education to uplift the hitherto impoverished including differently abled communities in India.

In 1988, this institution started as Santhigiri Rehabilitation Institute (SRI) with an accessible hostel to accommodate 11 children with disabilities. The goal of SRI was to get Persons with Disabilities (PwD) attain highest possible levels of wellbeing ensuring full participation in social life and development. In this respect, Santhigiri is running a Foster Care cum Formation Centre, regular Schooling, Vocational and professional education, Community Based Rehabilitation (CBR), Barrier-free housing, Health extension services, SHG (self help group) formation, Innovative employment promotion and Job placement, Matrimonial data bank, Helpline, Liaison and Institutional linkage services, etc. In 1993, the Santhigiri Vocational Training Institute and Santhigiri ITC were established. The Computer Centre was started in 1995. A Study Centre of Madurai Kamaraj University, Tamil Nadu was established in 1997. Santhigiri College of Arts and Sciences followed in 2001. Santhigiri College got affiliated to MG University in 2001, and AICTE approval was acquired in 2002. MCA was the first program to begin at Santhigiri College, followed by MSW in 2005. BCA and B Com (Computer Applications) programs were offered from 2006. The year 2008 saw the opening of the new five-floor college block and Girl's hostel. M Com and BBA programs began in August 2011. The Animation and Graphic Design program was open in July 2013. SCOP (Santhigiri College Outreach Program) was inaugurated in January 2014; B Com with Finance and Taxation in 2015, and B Sc Psychology in 2020. A well-equipped Indoor stadium was inaugurated in 2019. Santhigiri received multiple NSS Special Awards from MG University.

Under SCOP (Santhigiri College Outreach Program) the College is conducting Community Based Rehabilitation (CBR) Activities in 10 Panchayaths. College helped in the formation of 25 Self Help Groups (SHG) with more than 80 self-help projects. Very efficiently run are the Digital therapy programs for 40 Children with Disabilities (CwD), and the recently construction completed 250 barrier-free homes for the PwD along with multiple courses for a student strength exceeding 1400. The campus of Santhigiri College is 100% barrier-free.

Santhigiri Hostel for PwD Girls in 2002

Santhigiri Hostel for PwD Boys in 2002

New Hostel for D-A at Santhigiri (now)

Santhigiri College of Computer Sciences
Vazhithala, Thodupuzha

Motto, Vision, and Mission

Motto

Quality and Excellence

Vision

Awakening to the Future

[*The future of the students is moulded based on their intellectual capabilities*]

Mission

Holistic and Integral Development of the Individual
Rooted in Faith in God, Justice, Knowledge, and Human Values

The College provides affordable quality education, while equipping students
With knowledge and skills in their chosen streams, and thus
Shaping them into future leaders, entrepreneurs, and above all good human beings

At a Glance

1: General

I.1: General Particulars

Name of Educational Institution	:	Santhigiri College of Computer Sciences
Address	:	Vazhithala,Thodupuzha, 685 583 Kerala
Name of Local Body (Panchayat/ Municipality/Corporation)	:	Purapuzha Grama Panchayath
District	:	Idukki
Name and Designation of the Principal	:	Fr. Paul Parakattel CMI
Phone number	:	+91 94462 12911
E-mail ID	:	pparakattel@gmail.com
Name and Designation of the Contact (Teacher)	:	Mr. Joshy M Varghese IQAC Coordinator
Phone number	:	9400327073
E-mail ID	:	iqac@santhigiricollege.com
No of students selected for conducting the Survey & Data Collection (Green Guardians)	:	32

Basic Data

Current Academic Year	:	2021- 2022
Total number of students in the College during the Current Academic Year (M+F)	:	1,437 (881 M + 566 F)
Total number of Teachers in the EI during the Current Academic Year (M+F)	:	41 (14 M + 27 F)
Total number of other Staff in the EI during the Current Academic Year (M+F)	:	28 (21 M + 7 F)

Divyang-jan Particulars

No. of differently-able (*Divyangjan*) students, teachers, and other staff during the Current Year (M+F)	:	Students - 36 (28M+8F) Teachers - Nil Other staff - 6 (M)

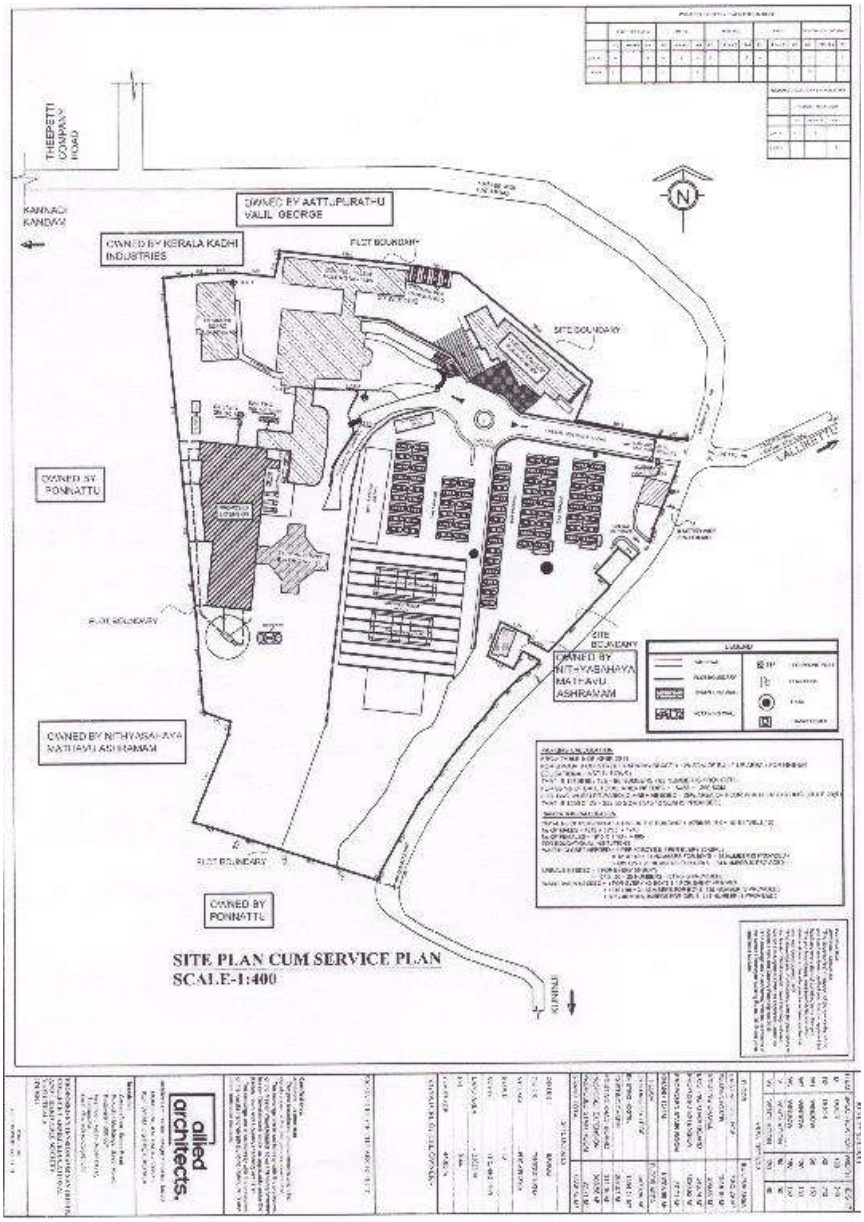
I.2: Details of Land and Buildings

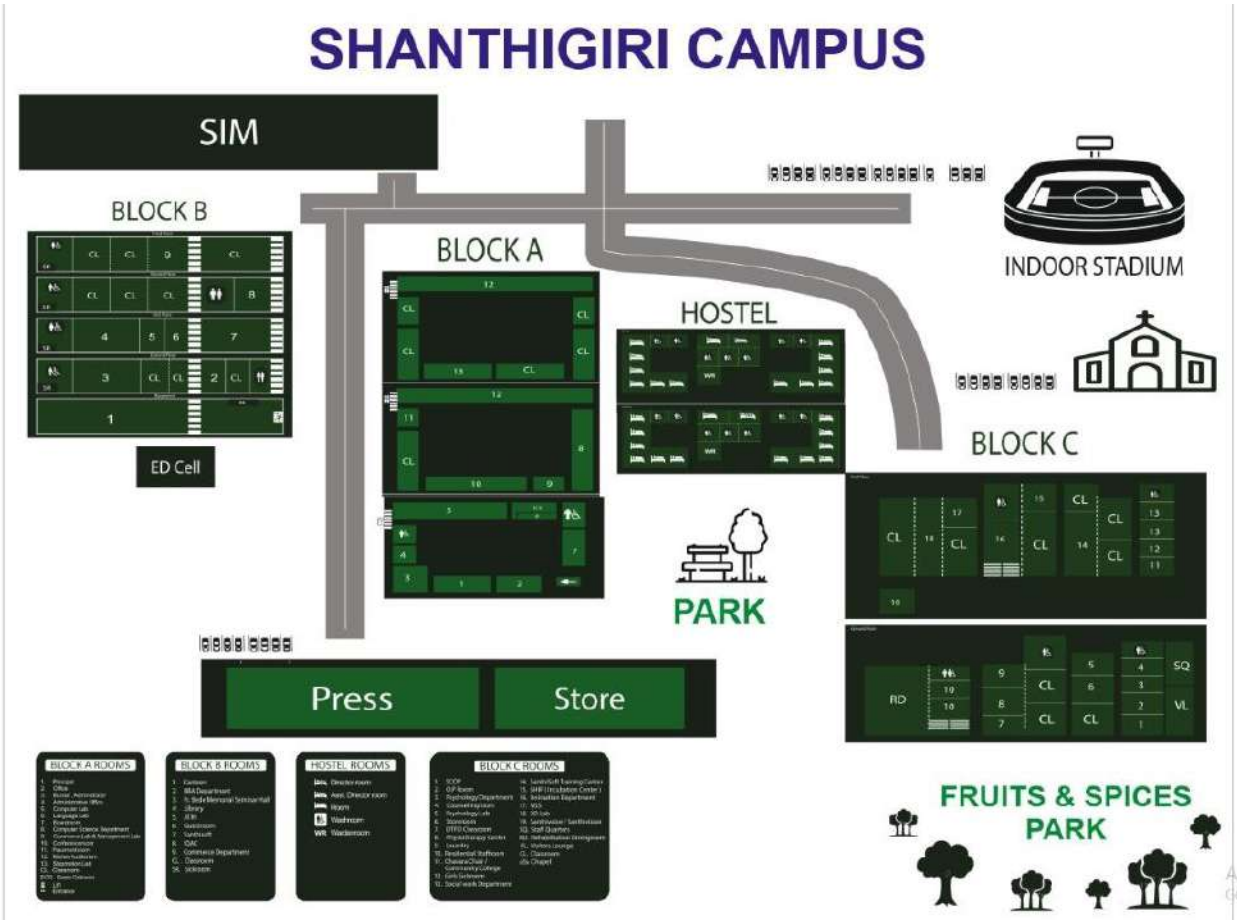
Building/ Block Name	Utility	Plinth Area (Sq. m.)	No. of Floors	Roof: Concrete Flat/Sloppy, Tiled, Sheet, etc.
Office Block	Academic	5,053	3	Flat
Auditorium	Assembly	239	1	Sheet
Library	Academic	2,676	4	Sheet
C Block	Academic	2,052	2	Flat
Chapel	Cultural	297	1	Sheet
Hostel	Stay	1,548	2	Flat
Play Ground	Sports	1,000	1	

Total Area of the Campus	(ha)	:	2.43
Area of Playground	(ha)	:	0.10
Area under open air Auditorium	(ha)	:	0.20
Area on Agriculture/Gardening	(ha)	:	1.20
Barren Area	(ha)	:	Nil
Area: Other purposes (specify).	(ha)	:	0.12
Area under Tree cover *Arrive at by reducing the total areas for different uses as above from the total area of the campus*	(ha)	:	1.70

Santhigiri College of Computer Sciences
Vazhithala, Thodupuzha

Layout of Buildings




SHANTHIGIRI CAMPUS
SIM
BLOCK B
ED Cell
BLOCK A
HOSTEL
INDOOR STADIUM
BLOCK C
PARK
Press
Store
FRUITS & SPICES PARK

Executive Summary

This Green Audit Report of the campus of Santhigiri College of Computer Sciences Vazhithala, Thodupuzha, Kerala, is prepared in a format that is easy for the students to comprehend the ecological and ethical values of learning at this higher education institution, as well as to get reminded on how each student can try to contribute to the ongoing greening initiatives of the College community. Their appreciation of the facts appraised in this report will go a long way in our Nation moving fast towards green living. 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 will of the Santhigiri community to work towards sustainable practices. The educated youth in any country should realise the truth that many of the natural calamities, being manmade, are avoidable. The ability of our people to cope with their impacts should have been built up in stages. In short, a change of lifestyle is inevitable for everybody, and that can be achieved only if the educational institutions assume with foresight their crucial role, and direct the youthful energy under their control to work towards a better tomorrow.

The findings of the Green Audit are only the 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 Mahatma Gandhi University, is preparing for gaining accreditation for its courses from the National Assessment and Accreditation Council (NAAC).

Green Auditing of a Higher Education Institution is a mandated activity as per Criterion VII (of the 7 criteria prescribed) under the 'Guidelines for Submission' of the mandatory annual Internal Quality Assurance Report (IQAR) by all Accredited Institutions in India. Santhigiri College, Thodupuzha, decided to have its premises and performance green audited by NGGFn as a definite step towards its leap into a greener abode of learning.

For many centuries, Kerala has been a favoured destination for foreign traders and visitors, and they liked to call this destination as Green and God's Own. NGGFn considers 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 in its State of Health, Environmental Quality, efficient Transportation & Communication, gender justice, as well as accessibility for the differently-able students, and exhibiting only a lower than average 'Carbon Footprint' through its activities over the entire year.

The youth here, as responsible future citizens, are to engage in efforts for 'building back better' after the repeated disasters and health threats. No curriculum of studies in the past had covered anything akin to the causes and remedies of the problems that the State and the Country are to face upfront. Therefore, students need to master the methods of analysing such situations objectively and act jointly for solving them. Students also realise that Green Audit is the way to grapple with such situations. Green Audit is a useful tool to know how and where an institution is using the most of energy, water, and other resources and plan for remediation.

The Green Audit process for Santhigiri College of Sciences and Technology during 2021-'22 therefore, involved the getting together of environment conscious student groups in the form of Nature Club, Bhoomithra Sena, and Green Guardians, and evaluating their own work for the year for areas other than their study subjects. An audit team with teachers and a team of experts who have practiced greening for years (including certified and accredited energy and environmental auditors and ecological administrators) through the Nature's Green Guardians Foundation (NGGFn) worked for its successful completion.

The results showed that, through the commitment of all concerned for maintaining a healthy environment in Santhigiri College, Vazhithala, Thodupuzha, Kerala, the **effective per capita carbon footprint during 2021-'22 could be pegged at the level of 0.054 T CO_2 eq., compared to the per capita national average of 1.91 T CO_2eq.** College has made deliberate efforts to conserve and further nurture the green resources, as also to provide gender justice, inclusive education for the differently able, and lessons for climate resilience. The Audit has made a number of observations to help the Management, the Staff, and the Students in their plans for making the college premises greener than that of others in Kerala State.

Prof. V K Damodaran
Chairman, NGGFn
Former (Founder) Director of S&T and Environment Department &
Former (Founder) Director of Energy Management Centre-Kerala
And Former Secretary to Govt. of Kerala (Ex-Officio)
International Energy & Environment Expert/ Ex-Consultant to UNIDO & UNEP
Trivandrum, 695 035. Dated: 14.12.2022

The Green Audit Team for Santhigiri College, Thodupuzha [2021 -'22]

Rev. Fr. Paul Parakattil, *Principal*
Rev. Fr. Biju Koottaplackal, *Manager*
Mr. Joshy M Vargehees, *IQAC Coordinator*
Ms. Anumol Joy, *Asst. Prof. (Social Sciences)*
Dr. Neetha T Thomas, *Asst. Prof. (Comp. Sciences)*
Mr. Gibin George, *Asst. Prof. (Comp. Sciences)*

Prof. V K Damodaran, *Chairman, NGGFn*
Dr. Sabu T, *Program Director, CED*
A M Narayanan, *Former Head, Energy Efficiency, EMC*
Hari Prabhakaran P S, *ISO 14001 Lead Auditor*
K Madhukrishnan, *CEO, Herbal Heritage Homes*
Ramkamal Manoj, *Managing Trustee, Chakshumathi*
Ms. Ranjini Damodaran, *Monitor (Gender justice and Accessibility)*

Santhigiri College of Computer Sciences, Thodupuzha

Green Guidelines

Unclean air, water, and surroundings are some of the biggest challenges faced by every nation on this planet, and all of us have a social responsibility in tackling them. Santhigiri College hence proudly put in place this Green Protocol, to be strictly adhered by all, as a mark of our solidarity to this cause.

Green Protocol

As a commitment to transforming and maintaining our campus as eco-friendly, let us:

1. Always use cups and containers that are washable and reusable
2. Bring snacks and lunches in steel or reusable containers
3. Practice 'Segregation at Source' of all wastes by using the colour coded bins provided
4. Value add the biodegradable wastes as compost and biogas
5. Store e-Wastes and inorganic wastes, clean and dry, and regularly dispose of them either to the Panchayath or to qualified and competent waste processors
6. Avoid the use of all types of disposables like plastic and paper for all functions.
7. Avoid 'use and throw' carry bags and insist on bags made of cloth/eco-friendly materials
8. Avoid the use of banners made of flex, and insist on cloth banners, e-banners, and e-notices
9. Avoid the use of balloons and plastic decorations, and instead use eco-friendly locally sourced leaves, flowers, etc. for decoration and for making bouquets on occasions
10. Avoid printing and photocopying on paper to the extent possible at all occasions
11. Avoid fossil fuel personal vehicles to the extent possible, promote public/college transport, and shared use of bikes and cars, and further switch over to affordable EVs to bring down the carbon footprint related to mobility and daily commutation
12. Reuse spiral bindings and hard plastic wrappers used in report submissions
13. Turn off water taps and electricity when not in use
14. Propagate the message of energy and water conservation, and of climate crisis, and explore opportunities for increased dependence on renewable energy like solar energy
15. Protect life sustaining natural resources such as wells, soil, and air in the campus as pollution free, help bio-diversity in the campus to grow further, and avoid the use of chemical pesticides and fertilisers once for all

The success of the Santhigiri Green Protocol
Will be evaluated periodically through Green Audits

Green Audit 2021 – '22: Procedures and Priorities

To impart higher education for the youth of a region, and elevate them to get empowered, the Santhigiri College of Computer Sciences has been working towards excellence in inclusive teaching and learning, while not forgetting to maintain the existing green surroundings. In order to identify and highlight the "shade of green" that this College has been able to elevate itself to, besides the green initiatives that had always been ventured into, the College decided to have a detailed green audit of the campus by the Nature's Green Guardians Foundation (NGGFn) during the academic year 2021-'22.

The college management, students, and the PTA are committed to keeping the premises as a "Green Campus", and are contributing towards environmental conservation and sustainable development. The college administration works on several facets of the philosophy behind "Green Campus" - including Water and Energy Conservation, Tree Plantation, Waste Management, Mapping of Biodiversity, Community Outreach, etc.

Towards Detailed Green Auditing

Maximizing performance efficiency through conservation and minimalism in all its activities is the broad objective of the stakeholders. This 'green auditing' is done for the academic year 2021-'22, even though the COVID-19 pandemic disrupted the decades-old routines of teaching and learning from March 2020.

The stakeholders of this temple of learning are expected to ensure the following:

a) Enhancement and coordination among various activities of the institution with increased importance given to ecological considerations and resources conservation;
b) Institutionalizing all good practices initiated as part of preparing for NAAC accreditation;
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 stakeholders including the students.

The Green Audit for the year was organised with abundant preparations, and by informing and involving all stakeholders including the PTA. NGGFn organises a green audit training workshop having a team of 6-7 experts, intended to equip the students and their mentor teachers with adequate theoretical knowledge and hands-on experience on up-to-date greening techniques and on audit per se.

The Procedures and Priorities that followed are:

Procedures:

1. Apart from the efficient use of energy, leading to substantial reduction in carbon footprint of the institution, the scope of renewable energy integration is also examined to realize reductions in avoidable imprints.
2. The procedure for Green auditing adopted by the team is to collect basic data on the components of green audit, with the help of Green Guardians, refining them by the Faculty and Mentors, and showcase achievements - through tables and photographs, wherever possible.
3. Set up feasible goals for the year ahead, and help to go up in steps.
4. Most importantly, convey the message to the community associated with the college, through the students and the adopted villages to bring about desirable changes in lifestyles, to the extent possible.

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 that emerge as the main emitters.
3. Convincing the management on investment required, as well as the return on investment that is possible, through the 'Life Cycle Cost' analysis method.
4. Assessing the momentum gathered on student initiatives towards making the campus greener and cleaner than before.

Santhigiri College, Thodupuzha

Campus Population in 2021-'22

Category	Male	Female	Total
Students	811	556	1,437
Teaching Staff	14	27	41
Non-Teaching Staff	21	7	28
Total	916	590	1,506

Programmes during 2021-'22

I	Post Graduate (PG) Programme
1	MCA
2	MSW
3	M Com
II a	Undergraduate Programme
1	BCA
2	B Com (Computer Application)
3	B Com (Finance & Taxation)
4	BBA
5	B A (Media Studies)
II b	Undergraduate Programme – B Sc
1	B Sc (Psychology)
III	Other Programmes (Certificate Programmes Offered)
1	CCA

1. Audit on
Green Campus Initiatives
1. 1. Campus Trespass Restrictions

The Santhigiri College, Thodupuzha, in Idukki district of Kerala maintaining high standards of academic instruction is one of the oldest colleges in this region. It is a mixed college with 1,437 students (40% girls), including 36 *divyangjans* during the audit year 2021-'22.

Though the College housed on a hillock has one more access gate, the daily entry of students and staff as well as visitors is mainly through this wide gate across the road, which is guarded by Security Staff. No stranger will enter the college premises, except on business, even then, without being verified by the vigilant Security staff. Those who enter the campus in motor vehicles – cars and bikes – or by cycling, including students and staff, are required to follow the movement guidelines by the campus security, and park their vehicles at the assigned parking area. Trespass is next to impossible.

1. 2. Use of Bicycles and EVs

Two wheeler parking in Santhigiri

With high population density, and roads which are not wide enough in an undulating and sloppy terrain, urban Kerala in general is unsafe for children to go cycling or walking along the roads. In addition, Idukki is the hill district of Kerala which makes it difficult yet to depend on two wheelers for daily college attendance. The annual road accidents in Kerala are close to 50,000 and this influences the students in their choice of mode of travel to the college. There are only 50 two wheelers in use in the college. When they were acquired by their owners, EV has not made an entry into this district's mobility market. 25 of them do practice vehicle sharing. Within the campus during working hours, staff and students walk the distance in between the buildings and the activity centres. The College administration and the Hostel as well as canteen management, in addition to some students, may occasionally hire three wheelers to come to the campus.

Vehicle Parking facility at Santhigiri

1. 3. Pedestrian Friendly Pathways

The Santhigiri College has most convenient, green, and shaded pathways linking the different college buildings/blocks, hostels, playgrounds, gym, sports and cultural activity areas. The different blocks are well networked, so as not to disturb academic work, if students, guests, or visitors were to pass by. The pathways are broad enough for groups of students to move in both directions at the same time, without crossing their ways or getting blocked. In addition, dedicated wheel chair tracks are also available in needed zones for the differently able persons.

Dedicated Wheel Chair Passageway

These roads are areas for carefree movements

Relaxed and Cool

The Audit team found the campus as very safe and hassle-free, for a rewarding learning environment.

1. 4. Plastic Free Campus

The Principal, the IQAC, NCC Corps, Bhoomithra Sena, Club Green Guardians and all other stakeholders at Santhigiri College, Thodupuzha are rigorously following the College Green Protocol and the Audit found that the students keep up their pledge of banishing plastics in letter and spirit. Avoidance of plastics is targeted for all activities including honoring of guests at functions. The students have gone out into the nearby villages under the NSS and NCC banners and to the homes around and persuaded the shop owners and employees, and the families in such areas to avoid plastics completely and embrace the 'Green Philosophy'.

Kerala Government too since 2016 is insisting on green protocol to be followed at public places, and this initiative of students in eradicating plastic menace, and combating climate change impacts, is truly supportive of the Kerala government's eco-initiatives. The campus has adequate number of colour coded waste bins in position. The first thing any new visitor to the campus feel is dismay at the unique litter free roads and spaces.

The Audit team could not find plastics strewn around anywhere in the campus during audit visits. There is a working policy for disposal or re-use of wastes in the College, and hence avoidance of plastics has become a 'lifestyle step-up' that the pupils have acquired from their studentship at this College.

Students have even changed their daily lifestyle by eliminating the use of plastic water bottles and lunch boxes (day scholars) and turning to steel substitute. Further, the use of plastic transparencies to formulate bouquets to the visiting VIPs has been done away with. Only single flower buds are offered to guests at college functions.

The work places of differently-able persons such as the Digital Design Room of the visually challenged and the printing and binding room of the PwD were also no exception to this campus culture.

1. 5. Landscaping and Gardening

The Santhigiri College, Thodupuzha, maintains its campus as a truly green garden. 'Nurturing the Nature' is a motto the students imbibe on joining the college for studies. From top of the buildings of this hill, the rural greenery is all around it. Within the campus the floristic composition is staggering. Small parks are protected within the campus and the students can learn as well as relax in these shaded areas. In addition, the campus has smaller hedges, and places under tree canopies with plants around, indoor stadium, and such other escapades for the students to relax at various parts, and they are maintained with care.

Gardens: Meenkulam – the fish pond at Santhigiri College

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 globalisation), 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 causes of biodiversity loss. In order to create awareness among the youth on conservation of biodiversity, there is a need for proper understanding on the biological diversity conservation initiatives at local level.

The Santhigiri College of Computer Sciences is located at 11˚52′09.95″ N latitude and 76˚38′41.04″ E longitude, in Vazhithala, Thodupuzha of Idukki district in Kerala. The college campus with an area of 2.43 ha is situated in the foothills of Western Ghats at an altitude of around 90 m. from MSL.

The campus with lush green vegetation on a hillock is attracting students in many ways. The management has given emphasis for conservation of the natural beauty of the area. The main stakeholders viz., the students therefore, are very much conscious of the need to maintain the green surroundings of the entire campus with their efforts. They are willing to touch and feel the plants and flowers, learn the plants by looks, and give care and maintenance to them as a part of their leisure hour activities in the campus.

The present program to conduct a biodiversity audit of the institute is not only intended to develop a biodiversity status report of the campus, but also to create awareness among the students on the need for conservation of the biodiversity as well as protecting the green areas in the campus by their involvement 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, awareness on the role of biodiversity and ecosystems in mitigating impacts of climate change will get deep rooted in their minds.

The vegetation and soil of a green space can not only sequester carbon, directly contributing to a reduction in atmospheric CO_2 concentration, but also affect the carbon balance indirectly, through their effects on the energy balance and thus on CO_2 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 College campus by involving the students and staff and developing 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
- Make the students capable of dealing with environmental and ecological issues of the surrounding area.
- Conduct a rapid survey on biodiversity composition of the campus and list out the species existing there.
- Find out the carbon sequestration potential of trees and other vegetation in the campus.
- Find out potential areas for Eco restoration within or outside the campus, and frame strategies for future interventions.
- Provide recommendations for future activities with respect to the scientific documentation of the campus biodiversity, and follow up activities to make the campus more biodiversity rich - by involving students and faculty members.

Methods

Vegetation plays an important role in the reduction of carbon dioxide from atmosphere through carbon sequestration. Active absorption of CO_2 from the atmosphere through the process of photosynthesis and its subsequent storage in different plant parts in the form of biomass in the growing plants is called 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 different groups and noting the plants with their local names. Photographs of the unidentified elements were taken and got identified by the NGGFn expert group. Both woody and herbaceous vegetation present in land uses inside campus can sequester carbon. But, for the purposes of this assessment, trees alone are 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 increments in the Non-Forest Land uses. Also, the other carbon pools and emission sources like soil carbon emissions, fires, etc. are not covered in this exrcise.

The girth of each tree at breast height (132 cm) is noted with its local/botanical name. Trees having girth 15 cm or more only are considered for calculating carbon sequestration.

Students collecting tree data in groups

The data collected were compiled by the expert team and the following analyses were done using standard procedures as follow:

1. Botanical identity of plants collected with common names
2. Status of plants based on its origin/distribution
3. Total number of trees present in each species (For Bamboos, number of clumps are considered)
4. Girth Range at Breast Height in centimetre (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).
6. The total carbon dioxide sequestered by the trees so far is arrived at 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 CO_2 equivalent is find out by multiplying it with 44/12.

7. The annual carbon sequestration potential is roughly estimated by using following assumptions:

a. Dicot tree sequestrate average 22 kg of carbon dioxide /year.
b. Coconut Palm sequester around 10 kg of carbon dioxide per year
c. Areca nut and others Palm 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

Only a quick survey of the floral diversity of the campus alone is conducted now. The survey revealed the following:

1. 171 species of higher plants belonging to 56 families were identified from the campus of which 130 are Dicots, 38 Monocots, 1 Gymnosperm, and 2 Pteridophytes.
2. The highest species diversity is in the family Poaceae (17 spp), followed by Asteraceae (15), Fabaceae (14), Euphorbiaceae (12), and Lamiaceae (8). Other major families are Rubiaceae (7 spp), Araceae Rutaceae (6 spp each, Apocynaceae, and Verbenacear (5 spp each), Amaranthaceaae, Arecaceae & Solanaceae (4 spp each). 5 families are represented by 3 species, 13 families by 2 species, and the remaining 25 families by 1 species.
3. Out of the 171 species present in the campus 88 are herbs, 23 shrubs including one parasitic shrub, 19 climbers, and the remaining 41 are trees. This shows that the diversity of tree species in the campus needs to be improved.
4. Out of the 171 taxa identified, 73 are exotic plants (43%) and 98 are native/ indigenous plants. Highest number of exotics found in trees is 19 out of 41.
5. 93 species are cultivated plants (55%) and the remaining 78 are growing wild.
6. It is worth mentioning that 115 taxa (67%) present in the campus are used in one or many Ayush medicines branches as detailed in Table 2.1.1. Further, the contents from 9 taxa are used in modern medicine.
7. 4 species found in the campus are highly invasive in nature (*Lantana camara, Mikania micrantha, Mimosa diplotricha, and Pueraria phaseoloides*) and are threats to the local biodiversity.

A detailed account on the results of rapid assessment of the floral diversity of the Santhigiri College of Computer Sciences campus is given in Table 2.1.1.

Table 2.1.1: Floristic Diversity

No.	Botanical Name	Common Name	Family	Habit	Distri-bution	Habitat	Medicinal Use
1	*Abelmoschus esculentus (L.) Moench.*	Ladies' Finger	Malvacea e	Shrub	Native	Cultivated	Ayurveda, Siddha, Unani, Folk
2	Abrus precatorius L.	Kunni-Bead Vine	Fabaceae	Climber	Native	Wild	Ayurveda, Folk, Homeopath Sidha, Tibetan and Unani
3	*Acalypha indica L.*	Kuppameni - IndianAcalyph a	Euphorbi aceae	Herb	Native	Wild	Ayurveda, Siddha, Folk, Homeopath
4	*Acanthospermu m hispidum DC*	Njerinjil	Asteraceae	Herb	Exotic	Cultivated	Ayurveda, Folk
5	*Achyranthes aspera L.*	Vankadaladi	Amarant haceae	Herb	Native	Wild	Ayurveda, Siddha, Unani, Folk, Homeopath Sowa Rigpa, Chinese
6	*Acmella calva (DC.) R.K. Jansen*	Palluvedana Chedi	Asteraceae	Herb	Exotic	Cultivated	Ayurveda, Folk
7	*Adonidia merrillii (Becc.) Becc.*	Christmas palm tree	Arecaceae	Tree	Exotic	Cultivated	
8	*Aegle marmelos (L.) Corrêa*	Koovalam-Bael tree	Rutaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk Homeopath Sowa Rigpa
9	*Aerva lanata (L.) Juss. ex Schult.*	Cherula-Mountain knotgrass	Amarant haceae	Herb	Native	Wild	Ayurveda, Siddha, Folk
10	*Agave sisalana Perrine ex Engl*	Chanakaitha-Cisal hemp	Agavaceae	Shrub	Exotic	Cultivated	
11	*Ageratum conyzoides L.*	Kumminnipac ha - Goat weed	Asteraceae	Herb	Exotic	Wild	Ayurveda, Siddha, Folk, Chinese
12	*Aglaonema commutatum* Schott	Chinese Evergreen	Araceae	Herb	Exotic		
13	*Allamanda cathartica L.*	Kolambichedi - Allamanda	Apocyna Ceae	Climber	Exotic	Cultivated	
14	*Alstonia scholaris (L.) R. Br*	Ezhilampla-Devil tree	Apocyna Ceae	Tree	Native	Wild	Ayurveda, Folk, Sidha Homeopath Tibetan, Unani
15	*Alternanthera bettzickiana (Regel) G. Nicholson*	Kattuponnam kanni-Calico plant	Amarant haceae	Herb	Native	Wild	
16	*Alternanthera sessilis (L.) R. Br. ex. DC.*	Ponnamkanni cheera-Sessile joyweed	Amaranth aceae	Herb	Native	Wild	Ayurveda, Siddha, Folk, Sowa Rigpa, Chinese

No.	Botanical Name	Common Name	Family	Habit	Distri-bution	Habitat	Medicinal Use
17	Ammannia baccifera L.	Kalluruvi – Blistering ammania	Lythraceae	Herb	Native	Wild	Ayurveda, Siddha, Chinese
18	*Ampelocissus indica (L.) Planch.*	Chembaravalli	Vitaceae	Climber	Native	Wild	Ayurveda, Siddha, Folk
19	*Andrographis paniculata (Burm. f.) Wall. ex Nees*	Kiriyath-Bhunimba	Acanthac Eae	Herb	Native	Cultivated	Ayurveda, Folk, Homeopath Unani, Sidha and Modern
20	*Annona muricata L.*	Mullatha	Annona Ceae	Tree	Exotic	Cultivated	Siddha, Folk
21	*Anthurium andraeanum Linden ex André*	Anturium	Araceae	Herb	Exotic	Cultivated	
22	*Areca catechu L.*	Kavug – Areca palm	Arecaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Homeopath SowaRigpa, Chinese, Modern
23	*Artocarpus heterophyllus Lam.*	Plavu -Jack	Moraceae	Tree	Native	Cultivated	Ayurveda, Siddha, Folk, Chinese, Modern
24	*Artocarpus hirsutus Lam.*	Anjili – Wild jack	Moraceae	Tree	Native	Wild	Ayurveda, Siddha, Folk
25	*Asystasia gangetica (L.) Anders.*	Upputhali	Acantha ceae	Herb	Native	Wild	Ayurveda, Siddha, Folk
26	*Axonopus compressus (Sw.) P. Beauv.*	Erumapullu -Buffalo Grass	Poaceae	Herb	Native	Wild	
27	*Baliospermum solanifolium (Burm.) Suresh*	Cheriyadanthi,	Euphorb iaceae	Herb	Native	Wild	Ayurveda, Siddha, Folk
28	*Bambusa vulgaris Schrad.*	Seemamula -Yello bamboo	Poaceae	Tree	Exotic	Cultivated	
29	*Bauhinia acuminata*	Shivamalli-Vellamandaram-Snowy Orchid	Fabaceae	Shrub	Native	Cultivated	Ayurveda, Siddha, Folk
30	*Bidens biternata (Lour.) Merr. & Sheriff*	Kandavarekuthi - Spanish Needles	Astera ceae	Herb	Native	Wild	Folk, Chinese
31	*Biophytum reinwardtii (Zucc.) Klotzsch.*	Mukkuty	Oxalida ceae	Herb	Native	Wild	Ayurveda, Sidha, Folk
32	Boerhavia diffusa L.	Thazuthama-Pigweed	Nyctagin aceae	Herb	Native	Wild	Ayurveda, Folk, Sidha, Homeopath Unani

No.	Botanical Name	Common Name	Family	Habit	Distri-bution	Habitat	Medicinal Use
33	*Bougainvillea spectabilis Willd*	Kadalasupoovu	Nyctaginaceae	shrub	Exotic	Cultivated	Folk, Sidha
34	*Caesalpinia pulcherrima (L.) Swartz,*	Rajamalli-Peacock Flower	Fabaceae	shrub	Exotic	Cultivated	Ayurveda, Siddha, Folk, Chinese
35	*Caladium bicolor (Ait. ex Dryand.) Vent.*	Varnachembu	Araceae	Herb	Exotic	Wild	
36	Callisia repens (Jacq.) L.	Turtle Vine	Commelinaceae	Herb	Exotic	cultivated	
37	*Calopogonium mucunoides Desv*	Calopo	Fabaceae	Climber	Exotic	Wild	
38	*Capsicum annuum L*	Mulak-Long Green chilly	Solanaceae	Herb	Exotic	Cultivated	Ayurveda, Siddha, Unani,Folk, Homeopath Chinese, Modern
39	*Capsicum frutescens L.*	Kantharimulak-Birds chilly	Solanaceae	Herb	Exotic	Cultivated	Ayurveda, Unani, Sidha, Folk Modern
40	*Cardiospermum halicacabum L.,*	Uzhinja-Heart's Pea	Sapindaceae	Climber	Native	Wild	Ayurveda, Folk, Sidha Homeopath Unani
41	*Carica papaya L.*	Pappaya	Caricaceae	Tree	Exotic	Cultivated	Ayurveda, Sidha Unani, Folk, Modern, Chinese Homeopath
42	*Catharanthus roseus (L.) G. Don*	Nithyakalyani-Madagascar Periwinkle	Apocynaceae	Herb	Exotic	Cultivated	Ayurveda, Folk Modern
43	*Centella asiatica* (L.) Urban	Kudakan-Asiatic Pennywort	Apiaceae	Herb	Native	Wild	Ayurveda, Folk, Homeopath Tibetan, Sidha and Modern
44	*Chassalia curviflora (Wall. ex Kurz) Thw.*	Yamari	Rubiaceae	Shrub	Native	Wild	Ayurveda, Folk
45	*Chromolaena odorata (L.) King & Robins*	Communist pacha-Siam weed	Asteraceae	shrub	Exotic	Wild	
46	*Chrysophyllum cainito L.*	Star apple	Sapotaceae	Tree	Exotic	cultivated	
47	*Cinnamomum malabatrum (Burm. f.) Blume*	Vayana,Edana	Lauraceae	Tree	Native	cultivated	Ayurveda, Folk
48	*Citharexylum spinosum L.*	Parijatham-Fiddlewood	Verbenaceae	Tree	Exotic	Cultivated	
49	*Citrus limon (L.) Burm. f.*	Cherunarakam -Lemon tree	Rutaceae	Tree	Native	cultivated	Ayurveda, Folk Unani, Chinese Homeopath SowaRigpa, Modern

No.	Botanical Name	Common Name	Family	Habit	Distri-bution	Habitat	Medicinal Use
50	*Citrus maxima (Burm.f.) Merr.*	Babloos / Kambilinarakam Pomelo	Rutaceae	Tree	Native	Cultivated	Ayurveda, Unani, Folk, SowaRigpa, Chinese
51	*Clitoria ternatea L.*	Sankupushpam Asian pigeonwings	Fabaceae	Climber	Exotic	Cultivated	Ayurveda, Folk, Tibetian, Unani and Sidha
52	*Coccinia grandis (L.) Voight,*	Koval	Cucurbitaceae	Climber	Native	Cultivated	Ayurveda, Homeopath Sidha
53	*Cocos nucifera L.*	Thengu – Cocconut tree	Arecaceae	Tree	Native	Cultivated	Ayurveda, Folk, Tibetan, Unani and Sidha
54	*Codiaeum variegatum (L.) A.Juss.*	Kozhivalan	Euphorbiaceae	shrub	Exotic	Cultivated	
55	*Coldenia procumbens L.*	Nilamparanda-	Boraginaceae	Herb	Native	cultivated	Ayurveda, Folk and Sidha
56	*Coleus amboinicus Lour.*	Panikoorkka-Indian borage	Lamiaceae	Herb	Native	cultivated	Ayurveda, Siddha, Folk, Homeopath
57	*Coleus scutellarioides (L.) Benth.*	Kannadichedi	Lamiaceae	Herb	Exotic	cultivated	
58	*Colocasia esculenta (L.) Schott*	Chembu – Wild Taro	Araceae	Herb	Native	Wild	Ayurveda, Folk, Unani and Sidha
59	*Cordyline fruticosa (L.) A.Chev.*	Ti Plant	Asparagaceae	shrub	Exotic	Cultivated	
60	Cosmos sulphureus Cav.	Yellow Cosmos	Asteraceae	Herb	Exotic	Cultivated	
61	*Curculigo orchioides Gaertn.*	Nilappana Black musale	Hypoxidaceae	Herb	Native	Wild	Ayurveda, Siddha, Unani, Folk, SowaRigpa, Chinese
62	*Cyanthillium cinereum*	Poovankurunnila-Purple fleabane	Asteraceae	Herb	Native	Wild	Ayurveda, Siddha, Unani, Folk, SowaRigpa, Chinese
63	*Cymbopogon flexuosus (Nees ex Steud.) Wats.*	Inchipullu – Ginger grass	Poaceae	Herb	Native	Wild	Ayurveda, Folk, Unani and Sidha
64	*Cynodon dactylon (L.) Pers*	Karukapullu - Scutch grass	Poaceae	Herb	Native	Wild	Ayurveda, Folk, Homeopath Tibetan, Unani,Sidha
65	*Cyperus rotundus*	Muthangapullu -Nut grass	Cyperaceae	Herb	Native	Wild	Ayurveda, Siddha, Unani, SowaRigpa, Chinese

No.	Botanical Name	Common Name	Family	Habit	Distri-bution	Habitat	Medicinal Use
66	*Dactyloctenium aegyptium (L.) P. Beauv*	Kavarapullu-Egyptian crowfoot grass	Poaceae	Herb	Exotic	Wild	Ayurveda, Folk and Sidha
67	*Dieffenbachia seguine (Jacq.) Schott,*	Dieffendachia	Araceae	Herb	Exotic	Cultivated	
68	*Digitaria ciliaris (Retz.) Koeler*	Henry's crabgrass	Poaceae	Herb	Native	Wild	
69	*Dracaena braunii Engl.*	Lucky Bamboo	Asparaga Ceae	shrub	Exotic	Cultivated	
70	*Dypsis lutescens (Wendl.) Beentje & Dransf.*	Yellow Palm	Arecaceae	Tree	Exotic	Cultivated	
71	*Eclipta prostrata (L.) L.*	Kayyunnyam, Bhringaraj – False Daisy	Asteraceae	Herb	Native	Wild	Ayurveda, Siddha, Unani, Folk SowaRigpa, Chinese
72	Eleusine coracana (L.) Gaertn.	Finger millet	Poaceae	Herb	Native	Cultivated	Ayurveda, Folk, Tibetan, UnaniSidha
73	*Emilia sonchifolia (L.) DC.*	Muyalcheviyan -Lilac tasselflower	Asteraceae	Herb	Native	Wild	Ayurveda, Folk and Sidha
74	*Epipremnum aureum (Linden & André) G.S.Bunting*	Money Plant	Araceae	Climber	Exotic	Cultivated	
75	*Euphorbia hirta L.*	Nilappala – Dove milk	Euphorbi aceae	Herb	Exotic	Wild	Ayurveda, Siddha, Unani, Folk Chinese
76	*Euphorbia milii*	Crown of Thorns	Euphorb iaceae	Herb	Exotic	Cultivated	Folk, Chinese
77	*Euphorbia pulcherrima Willd. ex Klotzsch.*	Poinsettia, Christmas flower	Euphorb iaceae	shrub	Exotic	Cultivated	
78	*Evolvulus alsinoides (L.) L.*	Vishnukranthi -Maoneywort	Convolv ulaceae	Herb	Native	Wild	Ayurveda, Siddha, Unani, Folk, Sowa Rigpa, Chinese
79	*Gardenia resinifera Roth*	Gummy gardenia-Dikamali kayam	Rubiaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Folk
80	*Gliricidia sepium (Jacq.) Kunth ex Walp*	Seema konna - Spotted Gliricidia	Fabaceae	Tree	Exotic	Wild	
81	*Glycosmis pentaphylla (Retz.) DC.*	Panal	Rutaceae	shrub	Native	Wild	Ayurveda, Folk, Homeopath Sidha
82	Grona triflora (L.) H.Ohashi & K.Ohashi	Cherupulladi – Three flowered begger weed	Fabaceae	Herb	Native	Wild	Ayurveda, Siddha, Folk

No.	Botanical Name	Common Name	Family	Habit	Distri-bution	Habitat	Medicinal Use
83	*Hesperocyparis macrocarpa (Hartw.) Bartel*	Monterey cypress	Cupress aceae	Tree	Exotic	Cultivated	
84	*Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.*	Oosipullu-Spear grass	Poaceae	Herb	Native	Wild	Folk
85	*Hevea braziliensis (Willd. ex A. Juss.) Muell.-Arg.*	Rubber tree	Euphorb iaceae	Tree	Exotic	Cultivated	
86	*Impatiens balsamina L.*	Balsam	Balsami naceae	Herb	Native	Cultivated	Ayurveda, Unani Sidha
87	*Indigofera tinctoria L.*	Neelayamari-Black Henna	Fabaceae	shrub	Native	Cultivated	Ayurveda, Folk, Homeopath Tibetan, Unani and Sidha
88	*Ixora coccinea L.*	Kattuthetti – West Indian Jasmine	Rubiaceae	shrub	Native	Wild	Ayurveda, Folk and Sidha
89	*Jasminum angustifolium (L.) Willd.*	Kattumulla	Oleaceae	Climber	Native	Wild	Ayurveda, Folk and Sidha
90	*Lantana camara L.*	Kongini – Lantana	Verben aceae	shrub	Exotic	Wild	Ayurveda and Folk
91	*Laportea interrupta (L.) Chew*	Anachorian	Urticaceae	Herb	Native	Wild	Folk
92	*Leucas aspera (Willd.) Link*	Thumba	Lamiaceae	Herb	Native	Wild	Ayurveda, Siddha, Homeopathy, Folk, Veterinary
93	*Lycopersicon esculentum Mill.,*	Thakkali – Tomato	Solanaceae	Herb	Exotic	Cultivated	Ayurveda, Siddha, Homeopathy
94	*Macaranga peltata (Roxb.) Muell.-Arg.*	Vatta	Euphorbi aceae	Tree	Native	Wild	Sidha, Folk
95	*Magnolia champaca (L.) Baill. ex Pierre*	Swarnacha mpakam-Goldenchampa	Magnoli aceae	Tree	Native	Cultivated	Ayurveda, Siddha, Folk, Sowa Rigpa
96	*Mangifera indica L.*	Mavu -Mango Tree	Anacardi aceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Homeopath, Folk Tibetan, Veterinary
97	*Manihot esculenta Crantz.*	Maracheeni - Tapioca	Euphorbi aceae	shrub	Exotic	Cultivated	Ayurveda, Siddha, Homeopathy
98	*Mikania micrantha Kunth*	Vayara – Bittervine	Astera ceae	Climber	Exotic	Wild	
99	*Mimosa diplotricha C. Wight ex Sanvalle*	Aanathott avadi -Giant Sensitive plant	Fabaceae	Climber	Exotic	Wild	

No.	Botanical Name	Common Name	Family	Habit	Distri-bution	Habitat	Medicinal Use
100	*Mimosa pudica L.*	Thottavady - Shameplant	Fabaceae	Herb	Native	Wild	Ayurveda, Siddha, Folk, Tibetan, Chinese
101	*Mimusops elengi L.*	Elangi -Bakul tree	Sapotaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Tibetan, Veterinary
102	*Momordica charantia L.*	Pavaikka – Bitter Gourd	Cucurbitaceae	Climber	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Tibetan, Veterinary, Chinese
103	*Morinda pubescens J. E. Smith*	Manjanaathi	Rubiaceae	Tree	Native	Wild	Ayurveda, Siddha, Folk
104	*Moringa oleifera Lam.*	Muringa - Drumstick tree	Moringaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Tibetan, Veterinary
105	*Murraya koenigii (L.) Spreng.*	Kariveppila Curry leaf tree	Rutaceae	shrub	Native	Cultivated	Ayurveda, Siddha, Folk, Veterinary
106	*Musa x paradisiaca L.*	Vazha Banana	Musaceae	Herb	Native	Cultivated	Ayurveda, Siddha, Unani, Homeopathy, Folk, Tibetan
107	*Mussaenda erythrophylla* Schum &Thonn	Red Mussaenda	Rubiaceae	Shrub	Exotic	c	
108	*Naregamiaalata Wight & Arn.*	Nila narakam	Meliaceae	Herb	Native	Wild	Ayurveda, Folk
109	*Nephelium lappaceum L.*	Rambootan	Sapotaceae	Tree	Exotic	Cultivated	
110	Ocimum basilicum L.	Ramathulasi - Rehan	Lamiaceae	Herb	Native	Cultivated	Ayurveda, Folk Siddha, Unani, Homeopathy, Tibetan,Chinese Veterinary
111	*Ocimum tenuiflorum L.*	Krishna thulasi Holy basil	Lamiaceae	Herb	Native	Cultivated	Ayurveda, Siddha, Unani, Homeopathy, Folk, Tibetan, Chinese
112	*Oldenlandia corymbosa L.*	Parpadaka pullu-Onathumba	Rubiaceae	Herb	Native	Wild	Ayurveda, Siddha, Chinese
113	*Oplismenus burmanni (Retz.) P. Beauv*	Mungil pullu-Berman's basket grass	Poaceae	Herb	Native	Wild	
114	*Oplismenus compositus (L.) P. Beauv.*		Poaceae	Herb	Native	Wild	
115	*Origanum majorana L.*	Marjoram	Lamiaceae	shrub	Exotic	Cultivated	
116	Osmoxylon lineare (Merr.)	Green Aralia	Araliaceae	shrub	Exotic	Cultivated	

No.	Botanical Name	Common Name	Family	Habit	Distri-bution	Habitat	Medicinal Use
	Philipson (Merr.) Philipson						
117	Oxalis corniculata L.	Puliyarila – Indian sorrel	Oxalid aceae	Herb	Native	Wild	Ayurveda, Siddha, Unani Homeopathy, Folk, Chinese
118	*Passiflora edulis l.*	Passion fruit	Passiflor aceae	Climber	Exotic	Cultivated	Ayurveda, Folk
119	*Peperomia pellucida*	Mashithand	Pipera Ceae	Herb	Exotic	Wild	Folk
120	*Persea americana Mill.*	Vennappazh am-Avocado Pear	Laura Ceae	Tree	Exotic	Cultivated	
121	*Phyllanthus amarus Schum. & Thonn.*	Keezharnelli-Gale of the wind	Euphorb iaceae	Herb	Native	Wild	Ayurveda, Siddha, Folk, Sowa Rigpa
122	*Phyllanthus emblica L.*	Nelli-Indian gooseberry	Euphorb iaceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Chinese
123	*Pilea microphylla* (L.) Liebm.	Artillery Plant	Urtica ceae	Herb	Exotic	Wild	
124	*Piper nigram L.*	Kurumulagu-Black pepper	Pipera ceae	Climber	Native	Cultivated	Ayurveda, Siddha, Unani, Homeopath Folk Tibetan,Chinese
125	*Portulaca grandiflora Hook.f.*	Pathumani poovu – Table Rose	Portula caceae	Herb	Exotic	Cultivated	
126	*Psidium guajava L.*	Peramaram - Guajava	Myrtacea e	Tree	Exotic	Cultivated	
127	*Pteris vittata* L.	Chinese Brake Fern	Pterida ceae	Herb	Exotic	c	
128	*Pueraria phaseoloides (Roxb.) Benth.*	Thottapayar	Fabaceae	Climber	Native	Wild	
129	*Racosperma mangium (Willd.) Pedley*	Manjiyam	Fabaceae	Tree	Exotic	cultivated	
130	*Rhinacanthus nasutus (L.) Kurz*	Nasgamulla	Acanth aceae	Herb	Native	cultivated	Ayurveda, Siddha, Folk, Chinese
131	*Rosmarinus officinalis L.*	Rosemary	Lamia ceae	Herb	Exotic	C	Chinese
132	*Ruta chalepensis L.*	Arootha-Herb of grace	Rutaceae	Herb	Exotic	Cultivated	Ayurveda, Unani, Folk
133	*Salvia splendens Sellow ex Roem. & Schult.*	Scarlet Sage	Lami aceae	Herb	Exotic	Cultivated	
134	*Saraca asoca (Roxb.) de Wilde*	Ashokam-Ashoka tree	Fabaceae	Tree	Native	Cultivated	Ayurveda,Siddh Homeopath Folk
135	*Selaginella kraussiana* (Kunze) A.Braun	Spike moss	Selagi nellaceae	Herb	Exotic	c	

No.	Botanical Name	Common Name	Family	Habit	Distri-bution	Habitat	Medicinal Use
136	*Setaria barbata (Lam.) Kunth*	Corn grass	Poaceae	Herb	Native	Wild	
137	*Setaria italica (L.) P.Beauv.*	Thina-Foxtail millet	Poaceae	Herb	Exotic	Cultivated	Ayurveda, Siddha, Folk, Chinese
138	*Setaria palmifolia (J. Koenig) Stapf*	Palmgrass	Poaceae	Herb	Native	Wild	
139	*Setaria parviflora (Poir.) M. Kerguelen*	Pravupullu	Poaceae	Herb	Native	Wild	
140	*Setaria pumila (Poir.) Roem. & Schult.*		Poaceae	Herb	Native	Wild	Ayurveda, Chinese
141	*Setaria verticillata (L.) P. Beauv.*	Bur bristle grass	Poaceae	Herb	Exotic	Wild	
142	*Sida acuta Burm.f.*	Malamkuru nthotti – Broom plant	Malv aceae	shrub	Native	Wild	Ayurveda, Siddha, Folk, Chinese
143	*Solanum americanum Mill.*	Manithakkali	Verben aceae	Herb	Native	Wild	Used in Ayurveda, Folk medicine
144	*Solanum melongena L*	Vazhuthana - Brinjal	Solan aceae	Herb	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Chinese
145	*Spermacoce latifolia Aubl.*	Tharavu	Rubi aceae	Herb	Native	Wild	
146	*Stachytarpheta jamaicensis (L.) Vahl*	Seemakongini Wild Verbena	Verben aceae	shrub	Exotic	Wild	Siddha, Folk, Chinese
147	Swietenia mahagoni (L.) Jacq.	West indian mahogany	Meliaceae	Tree	Exotic	Cultivated	
148	Synedrella nodiflora (L.) Gaertn.	Mudianpacha	Asteraceae	Herb	Exotic	Wild	Folk, Chinese
149	*Syzygium aqueum (Burm.f.) Alston*	Chamba – Water apple	Myrtaceae	Tree	Exotic	Cultivated	Folk, Chinese
150	*Syzygium jambos (L.) Alston*	Panineer chamba – Rose apple	Myrtaceae	Tree	Exotic	Cultivated	Ayurveda, Folk Unani, Chinese Homeopathy
151	*Tabernaemontana alternifolia L.*	Kuruttupala, Koonanpala	Apocyn aceae	Tree	Native	Wild	Ayurveda, Folk
152	*Tabernaemontana divaricata (L.) R. Br.*	Nadyarvattam East India rosebay	Apocyn aceae	shrub	Native	Cultivated	Ayurveda, Folk
153	*Tagetes erecta L.*	Banthi – Marigold	Aster aceae	Herb	Exotic	Cultivated	Ayurveda, Folk Siddha, Chinese
154	*Tectona grandis L.*	Thekk -Teak	Verben aceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Tibetan
155	*Terminalia catappa L.*	Badam, Adamaram-Indian Almond	Combr etaceae	Tree	Exotic	Cultivated	Ayurveda, Siddha, Unani, Folk

No.	Botanical Name	Common Name	Family	Habit	Distri-bution	Habitat	Medicinal Use
156	*Terminalia paniculata Roth*	Maruth-Flowering murdah	Combr etaceae	Tree	Native	Wild	Ayurveda, Siddha, Folk
157	*Tiliacora acuminata (Poir.) Miers ex Hook. f.&Thoms*	Vallikanjiram	Menisp ermaceae	Climber	Native	Wild	
158	*Tradescantia spathacea Sw.*	Rheo -Moses-in-the-cradle	Comme linaceae	Herb	Exotic	Cultivated	
159	*Tragia involucrata L.*	Choriyana mIndian stinging nettle	Euphorb iaceae	Herb	Native	Wild	Ayurveda, Siddha, Folk
160	Trema orientale (L.) Blume	Pottamaram-Oriental nettle	Cannab aceae	Tree	Native	Wild	Ayurveda, Siddha, Folk
161	*Trichopus zeylanicus Gaertn. subsp. travancoricus (Bedd.) Burkill ex Narayanan*	Arogya pacha	Trichopo daceae	Herb	Native	Cultivated	Ayurveda Folk
162	*Tridax procumbens L.*	Kummini pacha – Coat-button	Astera ceae	Herb	Exotic	Wild	Ayurveda, Siddha, Folk
163	*Vigna unguiculata (L.) Walp.*	Payar – Yardlong bean	Fabaceae	Climber	Native	Cultivated	Ayurveda, Folk Unani, Chinese Sowa Rigpa,
164	*Wedelia trilobata (L.) A. S. Hitchc*	Amminippov Singapore daisy	Aster aceae	Herb	Exotic	Wild	
165	*Woodfordia fruticosa (L.) Kurz*	Thathiri – Fire flame bush	Lythraceae	Tree	Native	Cultivated	Ayurveda, Siddha, Unani, Folk, Sowa Rigpa, Chinese
166	*Zehneria maysorensis (Wight & Arn.) Arn.*		Cucurbit aceae	Climber	Native	Wild	
167	*Zingiber officinale Rosc*	Inchi -Ginger	Zingib eraceae	Herb	Native	Cultivated	Ayurveda, Sidha Unani, Modern Homeopath,Folk Chinese
168	*Zingiber zerumbet (L.) J.E. Smith*	Kattinchi-Wild ginger	Zingib eraceae	Herb	Native	Wild	Ayurveda, Siddha, Unani, Folk
169	Zinnia elegans Jacq.	Zinnia	Aster aceae	Herb	Exotic	Cultivated	
170	*Ziziphus oenopolia(L.) Mill.*	Thudali – Jackal jujube	Rhamn aceae	Climber	Native	Wild	Ayurveda, Siddha, Folk
171	*Zoysia japonica Steud.*	Korean Lawn grass	Poaceae	Herb	Exotic	Cultivated	

Tree Diversity and Carbon Sequestration Potential

Major findings of tree diversity and its carbon sequestration potential in the campus are:

- There are 108 trees having more than 15 cm girth at breast height present in the campus of which 51 are Dicot trees, 55 monocot trees and 2 Gymnosperm trees.
- The trees exhibit comparatively low species diversity with only 31 spp having more than 15 cm girth.
- The highest number of trees present is of Coconut Palm (50 Nos.)
- Almost all the tree species are cultivated for various purposes like fruit, shade, flower etc.
- Out of the 31 tree species present 16 (51%) are exotic plants, and 15 (49%) are native to India. However, regarding the number of trees present 69% are native trees and only 31% exotic trees. This is due to the high density of Coconut palms.
- The girth of the trees ranges from 15 cm to 190 cm. Since the campus is comparatively new, the largest tree is having only 190 cm girth.
- The total carbon sequestered by all trees in the campus so far is **86 ton.**
- The **annual carbon sequestration potential** of the Campus is estimated at only **2.8 ton.**

The details of trees with more than 15 cm height at present in the Campus is summarised in the table 2.1.2.

Table 2.1.2: Tree Girth Data

Sl. No.	Common Name	No. of Trees	Girth Range at BH (cm)	CO_2 Sequestered (kg)
1	Anjili-Wild jack	4	110-164	5437
2	Ashoka Tree	1	29	66
3	Avocado Pear -Vennappazham-	1	54	254
4	Badam	2	153-183	37
5	Christmas palm tree	4	34-151	5037
6	Cocconut Palm	50	50-80	25847
7	Edana-Vayana	1	23	40
8	Elangi -Spanish cherry	2	21-45	205
9	Golden chempa	1	190	3850
10	Gummy gardenia	2	94-112	2071
11	Kariveppila -Curry leaf tree	1	33	965
12	Koovalam-Bael tree	1	28	62
13	Lemon tree	1	17	21
14	Mahogany	2	38-75	636

Sl. No.	Common Name	No. of Trees	Girth Range at BH (cm)	CO_2 Sequestered (kg)
15	Maruth-Flowering murdah	2	106-145	3238
16	Mavu -Mango Tree	3	28-253	9508
17	Monterey cypress	2	20-24	74
18	Mullatha	1	23	40
19	Panineer chamba -Rose apple	1	32	82
20	Papaya	2	18-38	143
21	Parijatham-Fiddlewood	1	128	1640
22	Pera maram -Guajava	1	36	847
23	Plavu -Jack	4	16-20	93
24	Pomelo	1	63	355
25	Rambutan	3	22-120	1503
26	Seema mula-Yellow bamboo	1	13-35	10325
27	Star Apple	1	32	82
28	Thekk -Teak	4	25-110	5254
29	Vatta	2	23-28	102
30	Water Apple	2	15-21	49
31	Yellow palm	4	56-190	9783
Total		108	15-190	87646

Faunal diversity

The flowering/fruit bearing and tuberous plants present in the area make it a situatable habitat for many animals. The faunal diversity of the campus consists of many species of birds, butterflies, ants, and other insects/beetles, spiders and many soil organisms. A detailed analysis is yet to be done. However, a random survey of birds identified 29 species of birds in the campus which include some domestic birds like fowl, duck, turkey etc. The details are given in table 2.1.3.

Suggestions / Recommendations

1. 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 conservation importance.
2. This shall be properly maintained by NSS/Green Guardians volunteers and shall be periodically updated.
3. The trees in the campus shall be geo-tagged and monitored annually for girth increment, so that a real picture of annual carbon sequestration potential is got.

1	*Cairina moschata*	Muscovy duck	Anatidae
2	*Corvus macrorhynchos*	Large Billed Crow	Corvidae
3	*Centropus bengalensis*	Lesser Coucal	Cuculidae
4	*Centropus sinensis*	Greater coucal	Cuculidae
5	*Glaucidium cadiatum*	Jungle owlet	Strigidae
6	*Nisaetus cirrhatus*	Crested Hawk-Eagle	Accipitridae
7	*Alcedo Atthis*	Kingfisher	Alcedinidae
8	*Anas platyrhynchos*	Duck	Anatidae
9	*Nymphicus hollandicus*	Cocktail	Cacatuidae
10	*Columba livia domestica*	Pigeon	Columbidae
11	*Geopelia Cuneata*	Diamond dove	Columbidae
12	*Dendrocitta vagabunda*	Rufous Treepie	Corvidae
13	*Cuculus micropterus*	Indian cuckoo	Cuculidae
14	*Eudynamys scolopaceus*	Asian koel	Cuculidae
15	*Dromaius Novaehollandiae*	Emu	Dromaiidae
16	*Dicrurus paradiseus*	Greater Racket Tailed Drongo	Dururidae
17	*Lonchura Oririvora*	Java sparrow	Estrildidae
18	*Merops persicus*	Blue Cheeked Bee Eater	Meropidae
19	*Nyctyornis athertoni*	Blue tiled bee eater	Meropidae
20	*Numida meleagris*	Guinea Fowl	Numididae
21	*Passer domesticus*	House sparrow	Passeridae
22	*Gallus gallus domesticus*	Fowl	Phasianidae
23	*Meleagris gallopavo*	Turkey	Phasianidae
24	*Dinopium benghalense*	Blacked Rumped Flameback	Picidae
25	*Dinopium javanese*	Common Flameback	Picidae
26	*Agapornis Roseicollis*	Rosy-faced lovebirds	Psittaculidae
27	*Melopsittacus undulatus*	Budgerigar	Psittaculidae
28	*Psittacula eupatria*	Parrot	Psittaculidae
29	*Otus sunia*	Oriental Scops Owl	Strigidae

Table 2.1.3: Faunal Diversity (Birds)

4. There are vacant spaces available in the campus and these areas shall be judiciously utilized for increasing the biodiversity.
5. In order to get maximum benefits out of biodiversity conservation, there is a need for establishing more indigenous plants.
6. Planting diverse local species will help in more water conservation and in increasing the faunal diversity as well as in providing more ecosystem services. Some indigenous plant species growing in Idukki and Kottayam districts are suggested for the Santhigiri campus, which are given in Table 2.1.4.

7. In addition to this, 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 for a healthy living in their daily diet.
8. As there are spaces available in the campus, College 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. This will help in encouraging Farm/Educational tourism with a well-maintained greenery in the campus in the hillock and to attract more students to the campus.
9. A "special campus greening drive" with fast growing afforestation techniques like the "Miyawaki Model" also may be tried to keep the lead in the institution's climate change mitigation initiatives. The already begun activities in this direction may be further streamlined in a more scientific way.

Table 2.1.4: Trees and shrubs suggested for planting in vacant areas

Sl. No	Botanical Name	Malayalam Name	Family	Use	Conservation Status
1	*Aegle marmelos*	Koovalam	Rutaceae	Medicinal/ Edible fruit	
2	*Aglaia bourdillonii*		Meliaceae	Medicinal	Vulnerable endemic to SWG
3	*Alangium salviifolium*	Ankolam	Alangiaceae	Medicinal/ Edible fruit	
4	*Annona reticulata L.*	Aattha Rama Sita Custard apple	Annonaceae	Medicinal/ Edible fruit	
5	*Annona squamosa L.*	Atha	Annonaceae	Medicinal/ Edible fruit	
6	*Antidesma ghaesembilla*	Kattu pulinchi	Euphorbiaceae	Medicinal	
7	*Aralia malabarica*		Araliaceae		Vulnerable Endemic to SWG
8	*Ardisia solanacea*	Kakkanjara	Myrsinaceae	Medicinal	Bird's Attraction
9	*Artocarpus gomezianus ssp. zeylanicus*	Kattukadaplavu Puli chakka	Moraceae	Medicinal	
10	*Artocarpus incisus (Thunb.) L.f.*	Kadaplavu Bread fruit tree	Moraceae	Medicinal/ Edible fruit	
11	*Atuna travancorica*	Kallan kaimaram	Chrysobalan aceae		Endangered & Endemic to SWG
12	*Averrhoa bilimbi L.*	Irumban Puli	Oxalidaceae	Medicinal/ Edible fruit	

Sl. No	Botanical Name	Malayalam Name	Family	Use	Conservation Status
13	*Averrhoa carambola*	Chathura puli	Oxalidaceae	Medicinal-Edible fruit	
14	*Baccaurea courtallensis*	Mootti pazham	Euphorbiaceae	Edible fruit	
15	*Butea monosperma*	Chamatha Plash Brahmavriksham	Fabaceae	Medicinal	
16	*Chionanthus mala-elengi ssp.linocieroides*		Oleaceae	Medicinal	Endangered & Endemic to SWG
17	*Cinnamomum malabatrum*	Illavangam, Vayana	Lauraceae	Medicinal	Endemic to SWG
18	Cynometra beddomei	Cherukoori	Fabaceae		Endangered & Endemic to SWG
19	Cynometra travancorica	Koori	Fabaceae		Endangered & Endemic to SWG
20	Diospyros candolleana	Karimaram Ebony	Ebenaceae	Medicinal	Endemic to SWG
21	*Elaeocarpus variabilis*	Kara	Elaeocarpaceae	Medicinal-Edible fruit	Endemic to WG
22	Euonymus angulatus		Celastraceae		Vulnerable Endemic to SWG
23	*Ficus auriculata Lour.*	Atthi Giant Indian Fig	Moraceae	Medicinal-Edible fruit	
24	*Ficus beddomei*	Thavittaal	Moraceae	Bird's Attraction	Endemic to WG
25	*Ficus benghalensis L.*	Peral Banyan tree	Moraceae	Medicinal Shade	
26	*Ficus benjamina L.*	Vellal Golden fig	Moraceae	Medicinal Shade	
27	*Ficus elastica Roxb. ex Hornem.*	Assam rubber	Moraceae	Medicinal Shade	
28	*Ficus exasperata Vahl*	Parakam Sandpaper tree	Moraceae	Medicinal Shade	
29	*Ficus hispida L. f.*	Erumanakku	Moraceae	Medicinal Shade	
30	*Ficus racemosa L.*	Atthi Udumbaram Cluster fig	Moraceae	Medicinal Shade	
31	*Ficus religiosa L.*	Arayaal Sacred fig	Moraceae	Medicinal Shade	

Sl. No	Botanical Name	Malayalam Name	Family	Use	Conservation Status
32	*Garcinia gummi-gutta*	Kudam puli	Clusiaceae	Medicinal Edible fruit	
33	*Garcinia indica*	Punam puli	Clusiaceae	Medicinal Edible fruit	Endemic to WG
34	*Gordonia obtusa*	Adangi Kattukarana	Theaceae	Medicinal	Endemic to WG
35	*Grewia tiliifolia*	Chadachi Dhanauna-vriksham Unnam	Tiliaceae	MedicinalEdible fruit	
36	*Hopea parviflora*	Kambakam-Malabar Ironwood	Dipterocarpaceae	Medicinal Wood	Endemic to SWG
37	*Humboldtia brunonis var. raktapushpa*	Chuvannakatashokam	Fabaceae	Medicinal	Endemic to Kerala
38	*Hydnocarpus pentandra*	Marotti	Flacourtiaceae	Medicinal	Endemic to WG
39	*Madhuca longifolia*	Iluppa -South Indian mahua	Sapotaceae	Medicinal Ornamental	
40	Memecylon flavescens	Kayampoo	Melastomataceae		Endangered Endemic to SWG
41	*Manilkara hexandra*	Khirni, Mullupala	Sapotaceae	Medicinal	
42	*Mesua thwaitesii*	Nangu	Cusiaceae	Medicinal	
43	*Myristica malabarica*	Malabar Nutmeg	Myristicaceae	Medicinal	Vulnerable, endemic to WG
44	*Neolamarckia cadamba*	Kadamb	Rutaceae	Medicinal	
45	*Olea dioica*	Kari veetti	Oleaceae	Medicinal	Vulnerable Endemic to India
46	Prioria pinnata	Churali , Ennappayin , Kiyavu	Fabaceae	Medicinal	Endangered & Endemic to SWG
47	*Pterospermum rubiginosum*	Chittila plavu Ellooti Malamthodali	Sterculiaceae	Medicinal	Endemic to SWG
48	*Spondias pinnata*	Ambazham	Anacardiaceae	Edible fruit	

Sl. No	Botanical Name	Malayalam Name	Family	Use	Conservation Status
49	*Strychnos nux-vomica*	Kanjiram	Loganiaceae	Medicinal	
50	Symplocos macrophylla	Malankuruvi	Symplocaceae		Endangered Endemic to SWG
51	*Syzygium travancoricum*	Vathamkolli maram	Myrtaceae	Edible fruit	Critically endangered Endemic to SWG
52	Tarenna nilagirica		Rutaceae		Vulnerable Endemic to SWG
53	*Vaccinium leschenaultii*	Kalavu	Vacciniaceae	Medicinal Edible fruit	Endemic to SWG
54	*Ziziphus mauritiana*	Lanthapazham	Rhamnaceae	Medicinal Edible fruit	

Mini Bird Sanctuary at Santhigiri








2. 2. Energy Audit

It is customary in Kerala to have daily energy use from very different sources – such as electricity, petroleum gas, diesel, petrol, firewood, solar electric, solar thermal, etc to minimise the expenses for getting energy services that are unavoidable for those living inside the campus as well as for the day scholars attending the programmes offered in the college. Most of the time, the major component of carbon footprint – an indicator of ecological performance - in an educational institution will be from energy related activities including transportation.

'Energy Audit' is a very useful activity through which every student and every connected family will be able to appreciate the importance of energy in their life. It is easy, at the same time profitable, to get the same or more of work done with judiciously chosen level of energy conservation. That is, follow the route of lesser consumption for getting the same work or service, and minimise the production of wastes. The major sources of carbon footprint (CF) are electricity and other energy forms, transportation, wastes linked to food preparation and consumption, as well as other normal wastes. During the current year's green audit, the data pertaining to electricity, transportation, and various types of wastes were monitored to see how much 'conservation conscious' are the stakeholders in the Santhigiri College of Computer Sciences campus at Vazhithala in Thodupuzha.

Electrical energy consumption nowadays is quantified as taking place during three distinct times as normal, peak, and off-peak (defined so, for tariff purpose) in different areas within the campus. However, Electricity is availed by Santhigiri College so far at medium voltage i.e., separate 415 Volt, 3-phase connections to different buildings. In the case of this college, the consumption as recorded by the Kerala State Electricity Board Limited and the monthly electricity charges paid are given in Table 2.2.1.

Month ->Charges	Energy Use Units (kWh)	Energy Charges Rs.	Average cost per unit Rs.
June 2021	2,173	9,940	
July 2021	2,220	19,917	
August 2021	2,080	10,029	
September 2021	1,940	9,940	
October 2021	1,840	9,980	
November 2021	1,920	19,068	
December 2021	1,920	19,068	
January 2022	2,502	9,953	
February 2022	2,080	10,029	
March 2022	2,951	9,950	
April 2022	2,951	30,357	
May 2022	2,951	20,434	
Year Total	**27,528**	**1,78,665**	
Monthly Average	2,294	14,889	Rs. 6.49

Table 2.2.1: Monthly consumption of Electricity and Charges Paid

The campus population of this Arts & Sciences College is 1,698 including the staff staying in the campus during 2021-22. Santhigiri's average monthly electricity consumption comes to 2,294 kWh (units). The annual energy consumption that accounts for GHG emission due to electricity use in the campus is therefore based on the total for 2021-'22 as 27,528 units. The per capita electricity use is 18 kWh per annum, which is very modest.

Transformer supplying electricity to Santhigiri College

Observations and Suggestions

1. As an educational institution, it is not possible for keeping a uniform demand level either daily or monthly. Yet, it is possible for raising the power factor (pf) closer to unity (1). In the case of Santhigiri College, there is not enough recorded data on power factor, sector-wise electricity consumption (like in the hostel, canteen, class rooms, etc.)
2. A College with large number of computers with UPS devices in the circuit, needs to be analysed more precisely through a detailed energy study to find out the power quality, as well as 'phantom load' (drain in the off-state).
3. The extent of power failures and how often it fails (reliability) is also to be examined. A Register as in the model format shown below may be maintained

(Model Format): Record of Power Interruptions in the Campus

Date	Time failed	Time restored	*Gen Start	Gen Stop	Remarks/ Reason

Time: (Hour & Minute); *Generator or Solar source connected

College Power Centre

Standby Power Generator 125 kVA

1. The college initiated replacing of inefficient lamps and other fixtures this year, and this has to be vigorously continued till all inefficient devices are driven out of the campus.
2. It is suggested that a detailed (investment grade) energy audit with electrical safety audit is done for the campus to evaluate the system and consider economic opportunities through efficiency enhancement, and at the same time to bring the carbon footprint to the minimum.
3. Further, it is desirable that the college owns the distribution transformer, and receive electricity at 11 kV (11,000 Volts) as an HT consumer. This will ensure that the academic work, water pumping, etc. won't get disrupted due to power interruptions and quality problems.

2.2.1. Energy Efficiency Improvement

In any energy application area, the most attractive opportunity in the path of greening is by replacing incandescent (ordinary) bulbs and ordinary fluorescent tubes. Reduction in Carbon Footprint arises due to electrical energy savings from more efficient lighting devices like LED lamps. One 4 ft tube (1200 mm long) can save 36 Watt at least. Assuming 6 hrs per day of use, and 250 working days in a year, the energy cost savings (now at an average cost of Rs. 6.50/kWh) will be (36 W x 6 h x 250 d) divided by 1000 and multiplied by Rs. 6.50 That is Rs. 350 in a year from one tube lamp alone. Such a tube can now be purchased at a bulk rate of Rs. 250-300. That is 'money back' in less than 9 months. Assuming a minimum of 5 years' life for the tube, the net profit from each replaced tube is over Rs. 1,500 for an investment of Rs. 250.

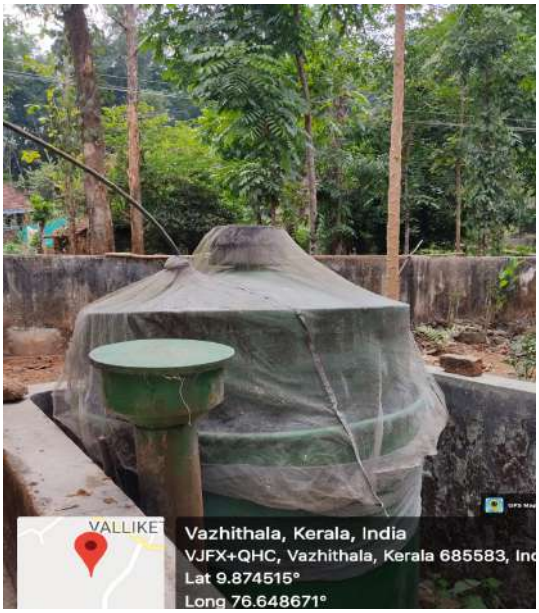
Good quality tubes may last much longer than 5 years. It will be an illuminating exercise for the students to learn how much energy charges could the college save due to the use of better technology and compare it with the investment required and learn about the 'Life Cycle Cost' approach. Life cycle cost means the initial purchase cost plus the cost of using and maintaining it for its life period. This can be compared with the low efficiency devices to identify profits. Students can very well plan to save on energy charges on their own - for their families too.

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. This will help in: (i) improving safety to the users and the equipment, and also (ii) reducing 'Phantom load' (in 'switched off' condition).
2. Prepare a Maintenance schedule for the switchboards and distribution boards, and exhibit them for all stakeholders 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 Energy Meters for sub-units (different Blocks, hostel, auditorium, laboratories, canteen, pumping, etc.) for monitoring and managing the monthly energy consumption in those buildings/divisions.
5. The College should also consider having dependable back up power of adequate capacity by way of solar power to ensure uninterrupted electricity supply to "essential" loads. Connecting solar power to feed the KSEB Grid will entail economic gains, but quality of service will be had if we are independent of the power grid at all times or having essential loads alone supplied with unbroken service during college hours. Alternatively, eliminating D-G standby power using fuel oil should be the policy. Further, Solar Photo Voltaic power for electricity and solar thermal power for heating should be depended more and more for further greening of the College campus.

2.2.2 Renewable Energy Use Audit

The excessive warming of the globe was no doubt mainly 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 CO_2 - said to be owing to the increased use of fossil fuels for energy generation, for motive power, lighting, and for other industrial uses. Therefore, global warming can only be halted through reduced use of energy from fossil fuels such as coal, oil, and natural gas. More than 70% of electricity the Kerala state is enjoying is ultimately coming from fossil fuel power stations from states other than Kerala. Because of this, if we are to limit the energy use, it will go contrary to the efforts to develop and raise the welfare of the people. Yet, it is possible to improve our welfare using less energy, at the same time sticking on to increased energy efficiency, and energy through non-fossil, renewable sources, such as wind, sunshine, water, and biomass.

25 kW Solar PV System in Santhigiri



Bio Gas Plant

Solar Water Heater

Other Fuels Used

Energy sourced from sources other than electricity

1. LPG

No. and type of LPG Cylinders used during the year in different places							
(19 kg Cylinder) Canteen		(19 kg Cylinder) Hostel +Canteen		(14.2 kg Cylinder) Laboratory		(specify) Other places	
Commercial	Domestic	Commercial	Domestic	Commercial	Domestic	Commercial	Domestic
18	6	27				21	

2. Wood

Wood used/day in different places					
Canteen for cooking	Kg	Hostel For cooking	Kg	(specify) Place/Purpose	Kg
-	Kg	48/day 12 Ton pa	Kg		

3. Kerosene

Kerosene used/day in different places					
(specify) Place/Purpose	Litre	(specify) Place/Purpose	Litre	(specify) Place/Purpose	Litre
-	-	-	-	-	-

4. Biogas

Biogas used/day in different places					
Canteen for Cooking	Cum	Hostel For Cooking	Cum	(specify) Place/Purpose	Hours /cum
	m^3	1	1 m^3		

Table 2.2.2.1: Energy from sources other than electricity at Santhigiri College

Using HP Steam for Cooking

Observations and Suggestions:

1. With the specific objective of embracing increased use of renewable energy, and taking advantage of this window of opportunity, Santhigiri College students can propose a Roof Top Solar PV program exclusively for use within the campus and wipe off the College's carbon footprints completely or substantially, as well as to bring down the college's energy bills considerably. The present system of 25 kW size can be supplemented by another plant of equal size or even bigger. For this, the entire load requirements may be studied with future needs as well.
2. The potential of BLDC (Brush Less DC) Fans to reduce the energy consumption by a large margin – 26 to 28 W against 70 W of older fans – can be taken as an option to replace old fans in a phased manner.

BLDC Fans are available with remote control

3. The students under the Club Green Guardians, *Bhoomithra Sena*, etc. may also attempt to work out the size of a Biogas digester for the campus to fully utilize all the organic wastes – as 'two birds' in 'one shot', ie., to get the best disposal of all, and conserve energy.
4. The per capita energy and electricity consumption in the campus is seen to be low. Students may conduct a survey to find out whether these levels are adequate. Else, a plan for raising the consumption level may be prepared.

2. 3. Water Audit

Average annual rainfall in Thodupuzha is 1442 mm, compared to 3000 mm of Kerala as a whole. Generally, Kerala is considered as 'water rich' State. Yet, adequate and uninterrupted water supply for drinking, personal use, gardening, agriculture, and animal husbandry is uncertain in several districts of Kerala, especially in the northern districts, nowadays. Water conservation is hence a major essential activity that should be pursued as part of greening initiatives in Kerala. But, on the ground, many people including good many students in Kerala, are unable to think of a possibility of water shortage at anytime, anywhere in Kerala.

Globally, different regions have challenges of different degrees in regard to the issues related to water security is concerned. A joint study conducted by the Alliance for Water Stewardship, Carbon Disclosure Project (CDP), Ceres, The Nature Conservancy, Water Footprint Network (WFN), World Resources Institute (WRI), WWF, and the Water Mandate Secretariat in 2013 is very revealing. It attempts to familiarise the public with three terms: Water *Scarcity*, Water *Stress*, and Water *Risk*. Though these terms may sound similar, technically they mean different situations indicating different water availability situations.

"*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 scarcity is an "*objective reality"* that can be measured with accuracy across regions and over a time scale.

"*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. So, it is defined and interpreted differently, even when we experience the same degree of water scarcity or water stress. Many water-related conditions, such as water scarcity, pollution, poor governance, inadequate infrastructure, climate change, and others, create *risk* for many different sectors and organizations simultaneously.

We are cautioned generally about the 'water stressed' regions where 'extra care' is required for avoiding wasteful water use by children as well as adults, farmers and others. 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 India housing the lion's share (1.37 billion or18%). *So, India is also at risk.*

The disturbing fact is that these 17 countries could experience the biggest economic losses from climate-related water scarcity – up to 14% of GDP by 2050 - and as many as 3.5 billion people could experience water scarcity by 2025. It is in this context that the 'water audit' of Santhigiri College of Computer Sciences in Thodupuzha, is assuming importance.

Drinking Water outlets are plenty in Santhigiri campus

The Santhigiri College, the higher education institution being audited situated in Thodupuzha taluk has: 2 wells, 1 pond, and a Rain Water Harvesting (RWH) system, 2 OH water tank of 30,000 Litre, and 1 underground Sump of 100,000 Litre. One electric pump of 7.5 HP is operated every day for 3 hours to maintain uninterrupted water availability at all taps and toilets.

As the hostel inside the campus is for 112 girls, and as the family strength of 18 staff members staying within is 80 during the audit year, continuous water supply for about 200 residents is ensured. Including the day users, numbering nearly 1,500 the amount of water distributed is 12,000 LPD (Litre per day). This works out to 8 LPD for day scholars, which is too modest a figure. The community is practising a successful water management policy.

No.	Source	Details
1	KWA/Municipal/Supply	-
2	Own Well/s	2 wells
3	Pond/ Rain Water Harvest	Rain water is collected in a pond. This is the main source of water in the Summer season on campus. Pisciculture also done through rain water harvesting.

Table 2.3.1: Water Sources

No.	Item	Details
1	Water pumps: Electric/Diesel	7.5 HP
2	Overhead Tank/s, Capacity litre	18,000 L
3	Pumping hours	3 hrs
4	Total water supplied daily	12,000 LPD

Table 2.3.2: Water Distribution Particulars

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

No.	Water Source	Total persons using	Average time/ person (minute)	Water flow/ min. Litre	Disposal to Drainage %	Disp Open Space %	Disp Treated Reused %	Disp Soak Pit %
1	Overhead tank	1,547	1	1.5	50%	-	-	50%
2	Hostel tank	113	1.5	1.25	45%	-	55%	-

Table 2.3.3: Water drawal and disposal

As per the survey conducted to assess the quantum of water used for flushing, utensil washing, face washing, floor washing, bathing, cooking etc., the position during the current year is as given in Table 2.3.4 (Student Assessment). This is centred only around uses within the academic area. Separate water meters are not installed in the system to measure the use directly.

Rain Water Harvesting Tank

Therefore, the Student Green Guardians have collected data on water use as required for the green audit of the campus through representative surveys and user point assessments. These figures do differ widely from the actual. The water needs survey may be conducted afresh during the coming academic year.

Views of Over Head Water Tank – External and Inside views

No.	Water Used for	*Per Day Total
1	Toilet flushing	500 LPD
2	Cooking	120 LPD
3	Utensils Wash	400 LPD
4	Floor Wash	450 LPD
5	Gardening	50 LPD
6	Bathing/Personal cleaning	150 LPD
7	Other/	100 LPD
8	Other/Occasional	200 LPD
9	Loss thro'- tap leaks	15 LPD
10	Loss thro' pipe break	0 LPD
	Total	1985 LPD

- Limited to Academic area only

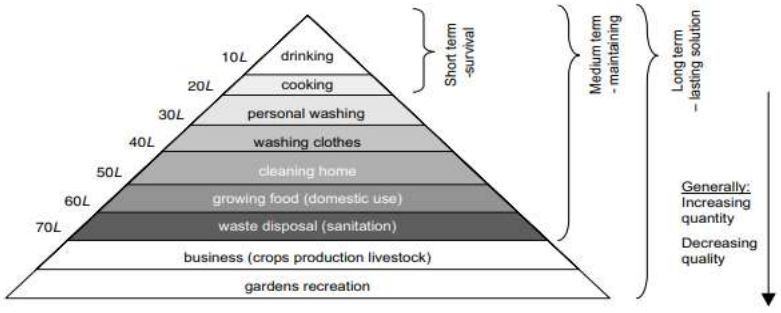
Table 2.3.4: Water Consumption – Students' Assessment

Under the current situation, there is no need for the campus community to depend on KWA (Kerala Water Authority) public water supply. The various functionalities for which this water is utilized is assessed by the student volunteers through surveys as above and sample measurements taken at user end (see table 2.3.1 to 2.3.4). Through repeated awareness and education programmes, the students have acquired the 'water use behaviour' of water-stressed areas, and is therefore very conscious of the need to use water in a frugal way.

Santhigiri College Water Purifying Plant

Observations and Suggestions:

1) The bodily water needs of a person per day (drinking) are generally close to 2 LPD and with cooking etc., the total personal needs may come to 16 LPD. The college has provided water supply far above this and close to the national dictates in this regard. Bureau of Indian Standards BIS 1172-1993 had set a per capita LPD of 100-150 for India, which was again revised in 1998 to a realistic 70 LPD per capita.



Hierarchy of Water Needs

{Prepared similar to 'Hierarchy of Needs' by Abraham Maslow (1908-1970)}

2) The total water use works out to about 45 LPD for campus dwellers and 8 LPD for day scholars. Most day scholars bring water bottles from home for their drinking requirements. Under such conditions, these levels are satisfactory.
3) The water related structures in the campus are fully functional, but they lack proper attention, maintenance and monitoring.
4) Conservation of water through effective rainwater harvesting is considered as a helpful educational activity, to appreciate the potential impacts of climate change, and for building resiliency against such impacts.
5) Audit suggests that it will be beneficial for the college to prepare a 'needs sheet' based on the various utilization zones, and also assess the current pumping efficiency and look for an optimized internal water supply system. Student Green Guardians, *Bhoomithra Sena*, and Eco-club members together can help in conducting the needs survey, and make the College water management system a replicable one.
6) The practice of re-using grey water for gardening as is done in many other colleges in Kerala is acceptable and Santhigiri College should try to cultivate fruits and vegetables for at least part of the campus requirements.
7) The water quality, as proved by testing at regular intervals is acceptable. However, attempt should be made to obtain test certificate from a statutory laboratory. Water quality has been declining in most parts of India, and in Kerala, as a result of development activities of various kinds. To protect our society from continuing with the use of polluted water sources, these data would serve as useful indicators.

(Model) Register for Water Quality Test

Date Sample taken	Tested by (Lab.)	Findings	Other reference

While College Chemistry laboratories may make very frequent routine checks, seasonal checks may be got done by nearby Statutory Labs like the District PCB Lab.

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

[Waste, Transportation, Health & Environmental Quality]

Santhigiri College in Thodupuzha focuses its attention more on nurturing healthy minds in the students and an ethical attitude in them. It is well known that bodily health is not possible without a 'Healthy Planet Earth'. The health of Planet Earth, in turn is ensured only through a 'Clean, Green and Healthy' way of life by the people. Every citizen should therefore respect the laws of nature and try to lead a way of life very close to the ways of Nature.

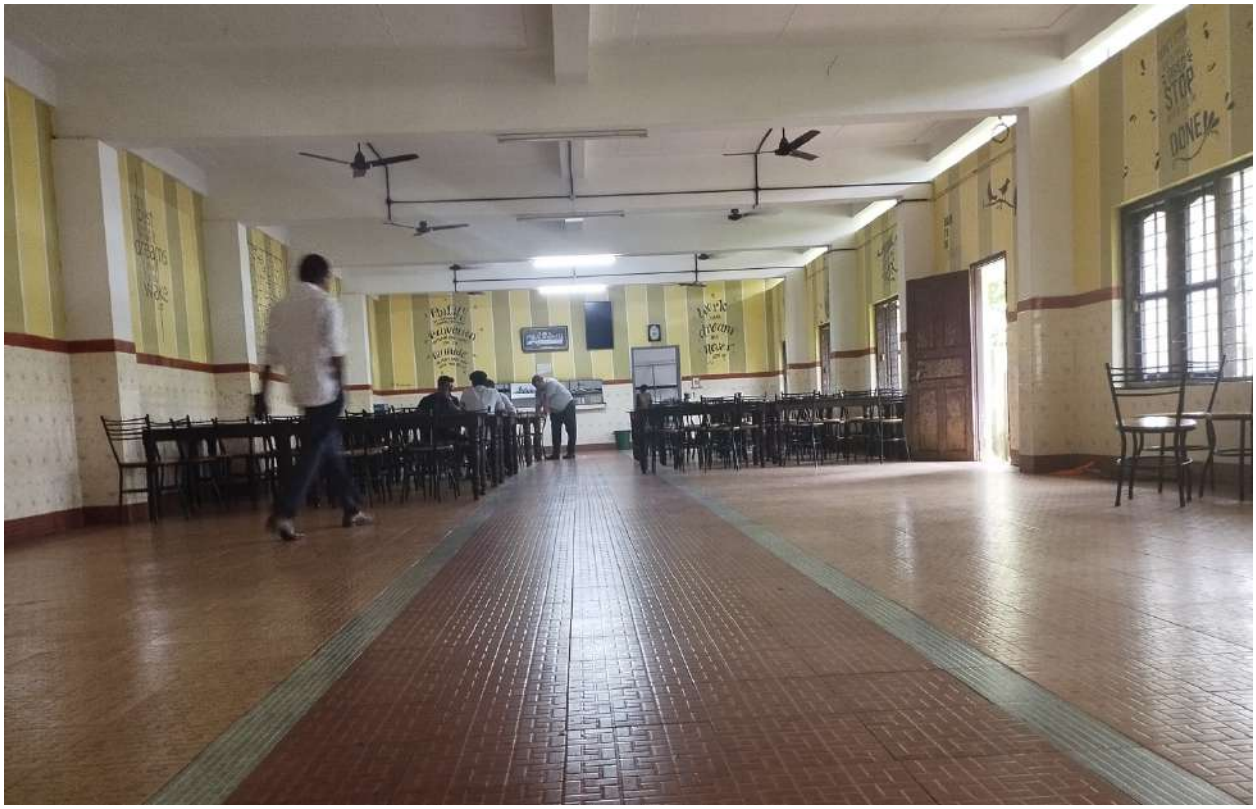
The Nature as we understand now is 4.5 billion years old, and the health of Nature - and its vicissitudes - have fed, as well as starved, millions of living organisms on and off, for long periods. The future citizens are, therefore, to be trained not to deviate too far from Nature's "limits of tolerance". Reckless lifestyles create problems of wastes, pollution to the environment through transport vehicles, and in general, results in the poor status of land, water, and air in terms of quality. The CGH audit is to ensure that the 'learning environment' for the students is of the right type, and healthy - in other words 'Green'.

2.4.1. Waste Audit

As any other established higher education institution operating in Kerala, Santhigiri College is continuing to dispose of its wastes in a hygienic but conventional manner. As the College has only about 200 persons living within the campus (only 13% of the stakeholders), and the area used predominantly for academic activities, that too mostly in full day light, the nature and quantum of wastes are only of a limited pattern and quantity. There will always be differences in quantity of wastes generated between workdays and holidays, as well as between seasons. An average figure per person per day for Santhigiri College activity type, is however worked out by observing students' activities through a sample survey (10% of students) for a week by the student volunteers, and inspecting the disposal area, quantifying the measured wastes, and then extrapolating for the whole campus.

For Indian academic campuses, assessment of wastes generation is done using empirical constants arrived at by research studies on waste generation, and these are given as guidelines for arriving at values for GHG emissions from wastes, and used in evaluating data on wastes in the campus. The summary of Data Sheets on Wastes with Auditors' Remarks is given in Tables starting from 2.4.1.1.

The wastes generation in the Santhigiri College, Thodupuzha, Idukki district is at a very low level possible. Every bit of waste is taken care of and disposed very satisfactorily and systematically through means suggested by Thodupuzha Municipality. Wet wastes are directed to reach the biogas plant and the energy obtained is used for cooking purposes.



Clean and Tidy Mess Hall (Canteen)

Array of Waste Bins: No dearth of one anywhere you turn

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	Abhijith Lakshmanan	120	5	5	5	5	Pen, refill, wrappers
2	Sandra K	40	10	8	5	2	,,
3	Vaishakh P K	60	5	5	5	5	,,
4	Christina Sali Jose	60	5	8	5	5	,,
5	Sanitha M	80	10	5	5	5	,,
6	Devanand K R	120	8	5	5	5	,,
7	Athira	120	8	5	5	5	,,
8	Shahana M	100	2	5	5	5	,,
9	Mufeeda M	120	10	5	5	5	,,
10	Praveena C	80	6	4	5	5	,,

Table 2.4.1.1: Waste Generation Data (Based on Sample Survey)

Sl. No.	Type of Waste Practice	Qty. kg/day	Type of Disposal	Remarks
1.	Food Waste by students & Staff	8.00	Collected by farm owners	
2.	Food Waste: Canteen + Hostel	10.00	Collected by farm owners	
3.	Paper Waste by Student& Staff College	5.00	Hand over to Haritha karma sena	
4.	Paper Waste Bulk: Canteen + Hostel	1.00	Hand over to Haritha karma sena	
5.	Plastic Waste – Individual	0.25	Collected by Haritha karma sena and disposed of at Nediya shala plastic shredder plant	
6.	Plastic Waste – Bulk: Canteen+ Hostel+ Office	1.00	Collected by Haritha karma sena and disposed of at Nediyashala plastic shredder	
7.	Glass & other utensils: Canteen+ Hostel+ Office	0		
8.	Electronic Waste: Canteen+ Office+ Laboratory	0.20	Hand over to approved Agencies	

Notes: (i). *Carbon footprint calculations are in Chapter - 4; (ii). Being of small quantity, alternative solutions are not possible; (iii). Simple paper recycling, and converting them into useful or ornamental pieces by the girls are worthy examples. (Based on Student Survey)*

Table 2.4.1.2: Summary of Wastes Audit in Santhigiri College, Thodupuzha

Adequate numbers of small garbage bins are provided in hostel rooms, as well as in the office and academic areas in the College. Large enough waste receptacles are deployed prominently in open areas accessible by visitors.

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
A Block	100	6	3	17	3	9
B Block	1000	22	4	15	3	9
C Block	200	13	1	14	3	6
Girls' Hostel	113	46	3	44	18	50
Total	1413	87	11	90	30	74

Table 2.4.1.3: Garbage bins placed

Electronic Waste Bulk Generation: Materials & Disposal Mode

← Waste Disposal ←

Place	Total Gen/day kg	Major Items	Disposal through Local Body %	Disp. in public area %	Disp. in Land fill %	Burn %	Re-cycle/ reuse %
Computer lab	0.15kg	Computer accessories	80%	-	-		20%
Main block	0.50kg	Tube light, bulb etc	75%	-	-		15%

Table 2.4.1.4: Electronic Waste Bulk Generation: Materials & Disposal Mode

No.	Item-Material	Unit	Quantity
1	Paper A4 80 gsm sheets	No.	110 bundle
2	File pad	No.	450 pieces
3	File Cover	No.	180 pieces
4	Paper Cups	No.	Nil
5	Paper Plates	No.	Nil
6	Other Paper Items		Nil
7	Printer Cartridge	No	100 pieces

Table 2.4.1.5: Stationery Used and Disposed

Observations and Suggestions:

1. Using waste paper has a better alternative way – that is to get paper pulp out of it, and to make handmade cards with nature colored designs. Encourage the students to use them as Greeting Cards, Sign Boards during events, etc.
2. As the college has much more girls than boys on the roll, napkins disposal facilities are important. Ensure that the incinerator facility is complying with the regulations in this regard, including the temperature level of elimination.

   Chemical wastes originate from the laboratories, and now from used printer cartridges etc. However, these are included in the electronic waste handling protocols. Glass wastes are also of limited scale. They are now disposed of safely.

2.4.2. Transportation Environment 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 Santhigiri College, buses are the only such option for daily commutation, since the region has no rail link.

The data on the number of people using bus and personal transport are collected by the student volunteers through a survey. Other than scooter and car owning persons, the rest of the students and staff, use college bus/public transport for their commutation.

Parking Facility

Table 2.4.2.1: Educational Institution Vehicles Operated during the Year 2021-22

Car/Bus Nos.	Average No. of Persons per trip	Total distance travelled during the Year (km)	Fuel Consumed (Litre)
5 Cars	Official travels and Emergency	3,700 km	320 L Petrol
11 Buses	Total 840/day	87,000 km	25,876 L Diesel

The emission calculation is made based on available data from test running: 2.3 kg CO_2/litre (petrol); 2.68 kg CO_2/litre (diesel) [DEFRA 2016]

Table 2.4.2.2: Transportation Use Pattern (Staff & Students)

1.	Motor bike/scooter (single, shared) Per day		
	a. No. of Motor bike/scooter	: 50	single/shared
	b. No. of Students	: 75	
	c. Total km travelled/day (To and fro)	: 500 km/pax	
2.	Auto Rickshaw		
	a. No. of Auto Rickshaws used	: Nil	
	b. No. of Students	: Nil	
	c. Total km travelled/day (To and fro)	: Nil	km/person
3.	Own Car (single, shared)		
	a. No. of Own cars	: 5 single; Nil shared	
	b. No. of Students/staff	: 5	
	c. Total km travelled/day (To and fro)	: 200 km to and fro	
4.	Shared Taxi Car		
	a. No. of Taxi cars	: Nil	
	b. No. of Students	: Nil	
	c. Total km travelled/day (To and fro)	: Nil	
5.	Private Van/Mini Bus/Bus		
	a. No. of Van/Mini bus used	:	
	b. No. of Students	:	
	c. Total km travelled/day (To and fro)	:	
6.	Public Transportation (Bus & Train)		
	a. No. of students	: 9	
	b. Total km travelled/day (To and fro)	: 180 km to and fro	
7.	Students Cycling to College		
	a. No. of students	: Nil	
	b. Average km travelled by person/day	: Nil km to and fro	
8.	Students Walking to College		
	a. No. of Students	: 15	
	b. Average km travelled by person/day	: 2 km/pax to & fro	

Buses need diesel having heavy carbon footprint, in other words contribute to the generation of greenhouse gases (GHGs) generally referred to as carbon emissions (in the form of CO_2, Methane, Sulphur compounds, Nitrogen oxides, etc.) and the total impacts are heavy. This has a direct bearing on the Global Warming and the consequent Climate Change (CC) effects. The purpose of Green Auditing is to make every staff and student understand the extent of damage each one inflicts on our planet and on our own environment. Accurate assessment of such environmental damages is a time-consuming exercise. At the UN Framework Convention on Climate Change (UNFCCC-21) in December 2015, India too had committed to bring down our country's Carbon Foot Print on the global environment. Every Indian – be it a student, teacher, or parent, or anybody else not connected with it directly, should know the measure of burden each one is inflicting on the environment, and try to bring such impacts to 'near zero' through all possible remedial actions.

'Greener travel' generally helps in keeping a low carbon footprint profile, but in the case of Santhigiri there are no such options available.

Emission of climate changing gases through transport system – both public and personal – is very high in India, and India stands third in respect to GHG emitting resource utilization globally. India is also at the 6th place in the 'after industrialization accumulated emissions' [170 years starting from 1850]. But, if we take per capita emissions, India is not a heavy polluter – it stands at 10th position only, and the quantum is less than one-third of the world average.

For assessing the carbon footprint due to transportation related to the functioning of the College, the following specific details were also gathered by student volunteers through the survey.

Sl. No.	Details: Type	No. of Vehicles	No. of Students/staff	Total km Daily run to & fro
1.	Motor bike/Scooter (Single/Shared)	50	75	500
2.	Auto Rickshaws used	0	0	0
3.	Own Car (Single/Shared)	5	5	200
4.	Taxi Car (Shared)	0	0	0
5.	Private Van/ Mini Bus	0	0	0
6.	Public Transport/College Bus	11	840	348
7.	Cycling to College	0	0	0
8.	Walking to College	-	15	30

Table 2.4.2.2: Summary of Transportation data for Students and Staff of College

The following additional assumptions are used for a rapid evaluation of the trend in the transportation related carbon footprint:

1. Parents and occasional visitors generally use public transport, own car or taxi only in a limited way.
2. Within the campus, students do walk regularly, and since all buildings are close to each other, ordinarily there is no need to use vehicles inside the campus.
3. Among the public transport (bus) users, there are private-bus and College bus users.
4. The management allows the hostellers to choose their own mode of travel for occasional family visits, as most of them are from middle class families. There are only 112 girl students as inmates in the hostel. Staff and their families residing in the campus are only 80 in number. Their occasional travels appear to be not a critical component of carbon footprint in the case of Santhigiri College, Thodupuzha.

Observations & Suggestions:

1. Audit appreciates the survey and detailed data gathering on the mode of commutation. This practice may be followed in future surveys as well. However, the distance range of bus users may be re-classified into 2 or 3 distance ranges close to the clusters identified: [Number within 6 km, 10 km, 10-20 km, & 20-30 km etc.].
2. The distance range of cars and motor bikes used by staff and students for commuting daily may also be studied with finer precision. Vehicle sharing option is not at all practiced except a few pillion riders.
3. Awareness on the benefit of using e-vehicles may be propagated more vigorously.
4. Every motor vehicle user should be reminded to plant additional tree/s within any greening exercise inside or outside the college campus, or at their own homes.

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 college campuses is to ensure that the students are able to live and learn in as rich a healthy environment as possible for being pampered with offerings to develop a young person's 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 Santhigiri College for 2021-'222 are:

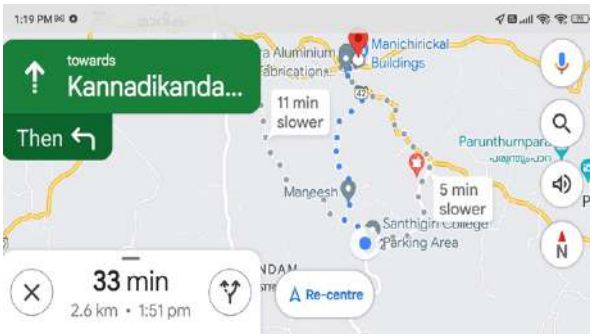
Sick leave: No major sick leave cases are reported. Kerala is known for its low mortality and high morbidity status in comparison to the national health status in India. This is because most mothers are educated, and because of that even a minor headache is promptly taken care of, at least at the nearest primary health centre, or a government or private clinic/hospital in the locality. It is true that most of the Colleges are not maintaining separate sick leave register for students. Audit found also that the Student participation in cultural and social activities is high.

Sick Room: There is Sick Room facility in the college as well as in the hostel to give the students the immediately needed medical attention. Members of NSS & NCC are generally specially trained in giving First Aid.

First Aid and Sick Room Facility

Emergency Medical facilities: There is arrangement for annual medical check-up for students, both boys and girls. In addition, if the students fall sick, they get free and priority emergency treatment at Mercy Hospital, Vazhithala (only 2.6 km away from the College). It is an established multi-speciality Hospital, and transportation to the hospital is also free to the students.

Counselling facilities and Individual Mentoring facilities are also available for every student. Those who need medical assistance according to other systems of medicine are free to have such consultation and treatment – for which facilities are available nearby.



Blood Donation: Many students of Santhigiri College are regular blood donors, registered with the Blood Donors' Forum as well as with the popular hospitals in Thodupuzha and nearby areas.

Blood donation by students

Sports & Games facilities:

Even as a new college in a relatively rural area, with about two-thirds of the students commuting daily between home and college, regular sports and games participation as well as contest achievements by the students are very common. The photos given within this Report are proof of the vibrancy maintained through physical education to the students of Santhigiri College.

Sports Achievements in 2021-'22

The Audit could notice that the Santhigiri girls forming 40% of student strength in this college are doing very well in Sports and Games competitions also, bringing laurels to their College, as well as to the home State, proving that a healthy physique always indicate the existence of a healthy learning environment in the college. These performances are in addition to their involvement in NSS, Eco-clubs, Literary and Cultural clubs etc.

Infrastructure

The sports infrastructure built up are excellent and a large number of boys and girls are utilising them for their physical and mental development.

Three Outdoor Badminton Courts

College Gym

Basketball Court

Vibrant youth of Santhigiri campus

Observations and Suggestions:

1. Santhigiri College, having tried to offer all facilities for students to participate in several competitions in sports and games, within the State and also beyond its borders, and enabled girls also to grow up healthy and emotionally strong, may now consider bringing more of them to leadership roles in society interaction programs.
2. Students may be divided into 'houses'/'teams' responsible for maintaining the physical infrastructure, greenery/biodiversity - planting, watering, nurturing & harvesting - of 'assigned' small areas, and each of the houses should compete for the coveted Principal's "Green Trophy", based on term-wise evaluation.

2.4.4. Environmental Quality Overview

The environmental quality of Santhigiri College of Computer Sciences in Thodupuzha is on the whole very good. The natural environment is maintained very well. The Principal, members of teaching staff, students, and the Parent Teacher Association are very much enthusiastic in conserving the nature, in moderating consumption, and in reusing and recycling materials appropriately wherever possible. This may be due to the following factors:

1. The college has from its beginning been very frugal in using electricity, and all other natural resources. The per capita values are relatively low.
2. The same concept of 'conservation of resources' has been followed in the case of water use as well. Available ground water sources as 'well water' are exploited at a sustainable level and purchase of water from Water Authority is not resorted to. Rainwater harvesting is done methodically. Opportunities to enhance these positives do exist and must be 'planned' to be strongly deployed.
3. The 2018 'Great Floods of Kerala, and landslides and excess rains of 2019 did not inconvenience the campus; instead, it could help those who were affected in multifarious ways utilizing the youth power and available resources of the College.
4. On the whole, this College Campus is seen to possess a good environmental quality conducive to serious learning by the students.

2.5. 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 Sciences 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 and 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.

2.5.1. Expression of Societal Commitment

At Santhigiri, such commitments are met by the students through: 1) Activities under NSS, as well as NCC, and 2) by maintaining the campus in tune with the natural environment through Bhoomithra Sena eco-clubs, Club Green Guardians and the like. Santhigiri College, along with other colleges in the Idukki district, has been doing a lot of social work, under the banner of National Service Scheme and the National Cadet Corps. The College leadership also encourages students to participate in activities of Nature Clubs, Eco club, Club Green Guardians, Arts Club, Friends of Earth brigade, etc.

Having participated in farming, such good harvests are heart warming

Cultural Programmes Reflect Creativity of the Youth

3. Audit on
Accessibility and Gender Justice
3.1. Built Environment and Accessibility Audit

Santhigiri College, Thodupuzha, has a student strength of 1,437 during the Audit Year 2021-'22. The total campus strength is 1,506.

Accessibility: There are 36 differently-abled students currently studying in the college. Students or Staff with physical, mental, or visual challenges have very special considerations in the campus of Santhigiri College.

Differently designed building for the Differently-abled
(Rehabilitation Centre)

No.	Type of DP	No.	Gender	Age	Affiliation
	Staff – Non teaching	-			
No.	Type of DP	No.	Gender		Course Studying
	Students	36	28M+8F		
1	Learning Disability	29	23M+6F		UG/PG/CCA
2	Physical Disability	7	5M+2F		UG/PG

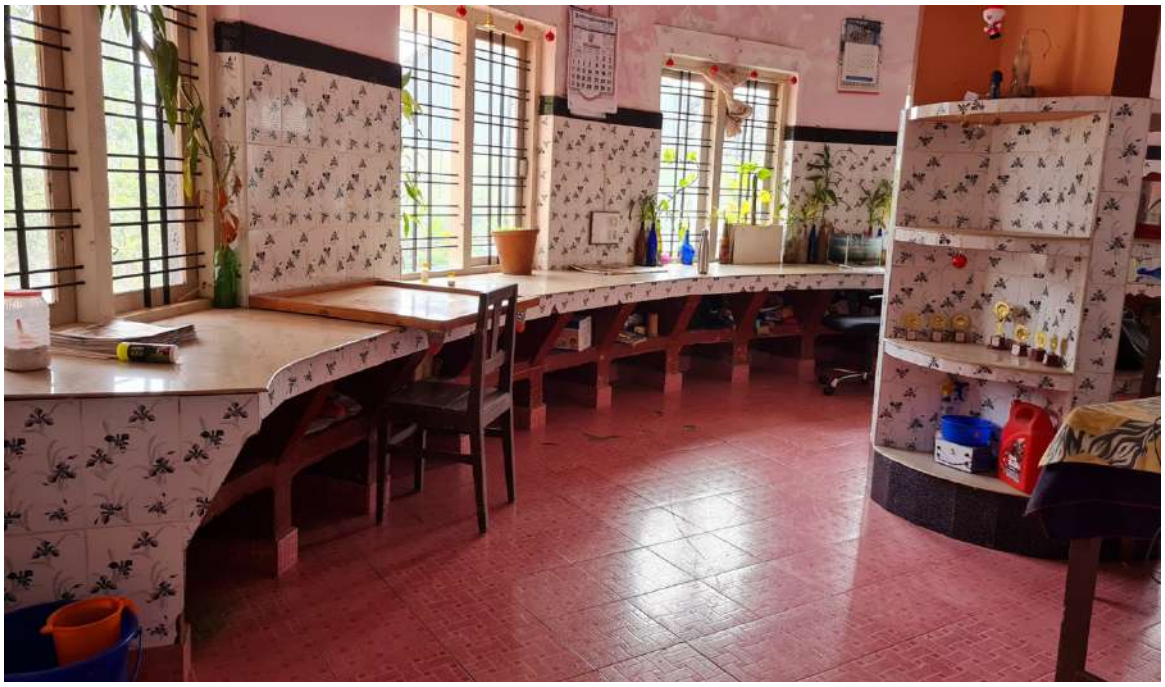
Table 3.1.1: Differently-able students at Santhigiri College, Thodupuzha (2021- '22)

Table 3.1.2 Preparedness for Inclusiveness with Differently Able

No	Accessibility Check Point	Data
1	How many gates for campus entry? How many are accessible/wheelchair entry type?	01 01
2	Any tactile marked lines for visually impaired persons?	Nil
3	Foot paths with wheel Chair marks? Foot path with tactile lines?	Nil Nil
4	Total no. of buildings? Multi-floors buildings?	03 03
5	***Building – A (Administrative Block)***	
a	Ramps with wheel chair accessibility	Yes
b	Tactile marking	Nil
c	Accessible Toilets – at Floor No:	G Floor – 2
d	Accessible Ladies Toilet	1
e	Accessible furniture (on demand)	Yes
f	Signage	Yes
g	Accessible parking	Yes
	Building –	
a	Ramps with wheel chair accessibility	Yes
b	Tactile marking	Nil
c	Accessible Toilets – at Floor No:	B Floor- 1 G Floor – 1 F Floor – 1 S Floor – 1 T Floor-1
d	Accessible Ladies Toilet	Yes
e	Accessible furniture (on demand)	Yes
f	Signage	Yes
g	Accessible parking	Yes
	Building – c	
a	Ramps with wheel chair accessibility	Yes
b	Tactile marking	Nil
c	Accessible Toilets – at Floor No:	G Floor – 2 F Floor – 2
d	Accessible Ladies Toilet, Floor	Yes
e	Accessible furniture (on demand)	Yes
f	Signage	Yes
g	Accessible parking	Yes

The buildings and their passageways are spacious enough for making effortless transiting possible. Ramps for independent self-navigated wheel chair entry are provided everywhere in the campus. The wheeling routes to different areas in the campus in an unobstructed manner are reviewed currently, and its positioning is progressing and is expected to be completed soon with international Signage. The buildings having multiple floors are already having special lifts.

The Institution with humanitarian considerations as its core vision, is understood to be envisioning expansion of such facilities required by the expected rise in *Divyangjan* stakeholders in the future. So, the College has decided to upgrade most of the needed and existing facilities hat contribute to the inclusiveness of the students having challenges of any kind. To this effect, a special audit on accessibility is planned to collate all needs and meet them in full. A non-profit Trust 'Chakshumathi – Assistive Technology Centre for the Blind, Trivandrum' is recommended for this special exercise during the next Academic Year (2022 – 23).

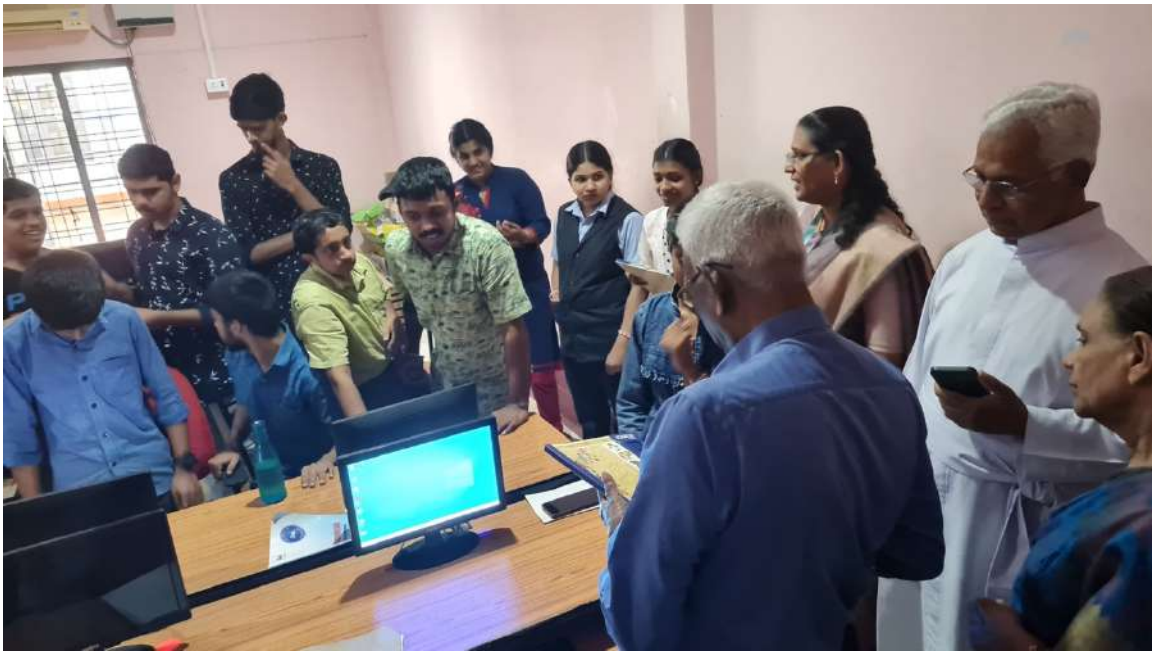


Differently-able friendly Accommodation

Accessible Passageways
Very well implemented at Santhigiri campus

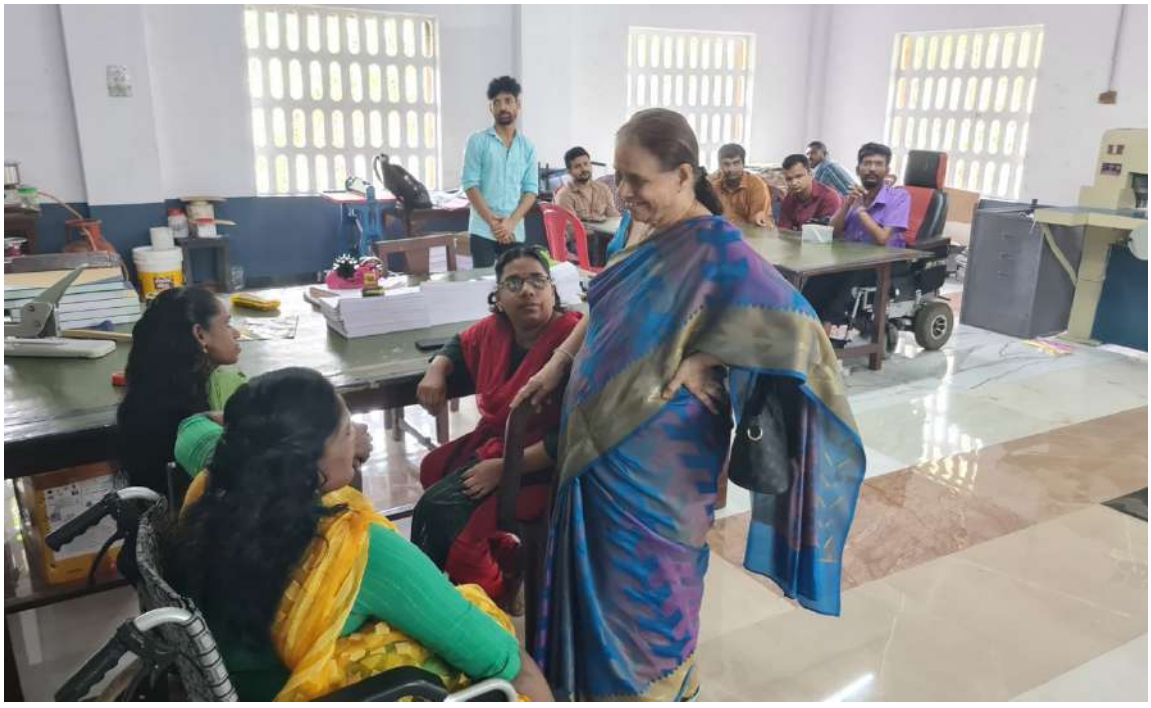
Santhigiri Rehabilitation Centre was supported by the Government of Japan

A training class on how to meet the accessibility needs in an educational institution is being given to the student volunteers, teachers, and managers within the campus. The college itself can self-audit accessibility preparedness through the trained staff and students. Simple modifications can make a great difference to the 'experiences in actual use' for the differently able persons.



The creative and learning activities of the visually challenged and other differently able students were reviewed through interaction with them during their regular class time by accessibility experts.

Accessible Industrial Workplace in Santhigiri



3.3. Audit on Signage and Guidance for *Divyangjan*

Differently-able persons – students and staff as well – can have the feeling of inclusiveness only if they are self-guided through easily understandable signage and guidance for locating and reaching the various venues, rest rooms, dining facilities, office and the common service areas.

Santhigiri College has ability challenged students of different kinds as of now in its rolls, and so the College has planned for proper signage and guidance, including floor signs to be installed according to international norms. Further, the D-A assistance when needed, starts from the point of entry through the security guards, and later through the Information Office, which is only 100 m from the main gate. Student volunteers are trained in 'Mobility' practices – how differently able persons are to be assisted, guided, or briefed. This will be extended to students joining environment related clubs and groups, as well as to all newly joining members of the faculty. The College is advised by the Audit to follow the international non-linguistic signs to be used.

Accessible Work Space for the Differently Able

Observations and Suggestions:

1. Wherever physical support is required, as well as equipment such as special wheelchairs, easy release door locks and latches, etc. are to be used for unaided free movement, the toilets, ramps, etc. should follow all the accessibility norms.
2. As a case in point, there shall not be doors or window leaves opening outward into the entry way of access, as it might hurt the entrant or obstruct seriously. No such danger spots were spotted in Santhigiri.
3. A special workshop may be arranged during the next available opportunity on how others in the campus can contribute to an 'inclusive environment' within a higher education institution. This could be educative on "Accessibility requirements" to the management, entire staff, and all students, and the event should be organized with an accessibility expert present for interaction.

4. When accessibility rendered spots are not used regularly, sometimes cleaning staff and casual workers employed for small tasks may find it useful to make such open areas for stacking sparingly used tools and furniture. The Estates Officer of the college should inspect such spots in the campus with at least weekly regularity, and sign inspection slips/tags with compliance status recorded promptly.
5. Like having fire safety training (even when there has been no history of fire hazards in the past), accessibility training to all levels of employees in administration should be imparted every year to make the campus further "*divyanganjan*-proof".

Slight changes in protocols make work spaces accessible for the D-A

3.4. Audit on Introduction of Assistive Technologies

Santhigiri College has all the accessible software, and appropriate screen readers for computers at the main library and in the D-A class rooms. Also, it is planned to have 'book share' membership meant for the visually challenged readers, and offer these facilities for such needy students or 'print disabled' elders in the vicinity free of charge. This will keep the college owned assistive technologies duly updated and glitch free, at the same time 'adequately used'.

Independent movements for differently abled need not depend only on wheel chairs and ramps. Guard wheel fitted scooters and special EVs are introduced at Santhigiri for its D-A workers and interns to move around different workplaces and a little – distant activity areas.

3.5. Focus on Environment in Outreach & Social Service

For healthy living, environment plays an important role. Students are made to understand that it provides all living beings with air, food, etc. It is correctly said (Ayn Rand) that the difference between animals and humans is that "animals change themselves for the environment, but humans change the environment for themselves". Just like our neighbourhood, the surrounding state of the environment influences us, and also modifies our growth and development.

Therefore, all outreach and NSS programmes of Santhigiri are heavily weighted towards environment and sustainability related observances, interactions, and learning opportunities.

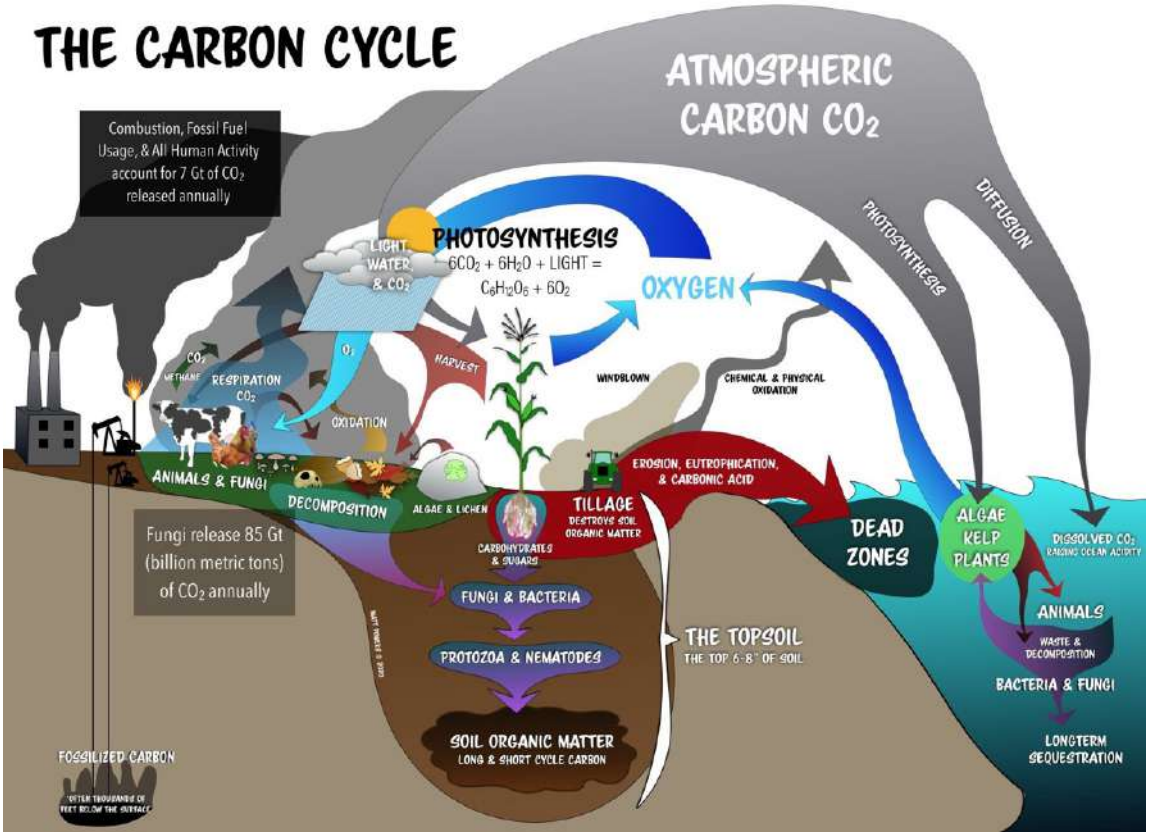
3.6. Audit on Universal Information and Enquiry Systems

The present arrangement of first interception for any visitor, parent or student at the Santhigiri campus is the IQAC room and its Information Desk, which can be directly accessed from the entrance road – less than 100 m from the gate. With the present-day affinity to social media, the College has transferred several details required by prospective students and employees to the online platform and social media. However, updating these data and instructions is a tough challenge which every College will have to take up seriously. Even within the course of an academic year, these are liable to variations or change.

Such updating work is very important, but will be easy if tech-savvy student volunteers are made responsible and vigilant on its correctness.

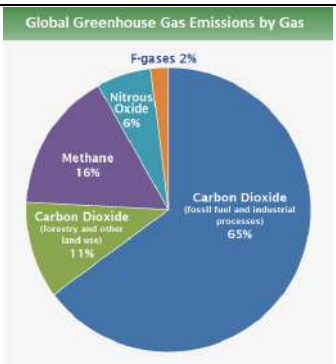
4. Carbon Footprint

Carbon Footprint is a measure of the total greenhouse gases emissions 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 (CO_2).*



The diagram above is due to Matt Powers, a famous author and powerful 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 liveable 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, not ruling over it. 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." "We are dealing with an Oxygen problem as much as a stagnating Carbon cycle".

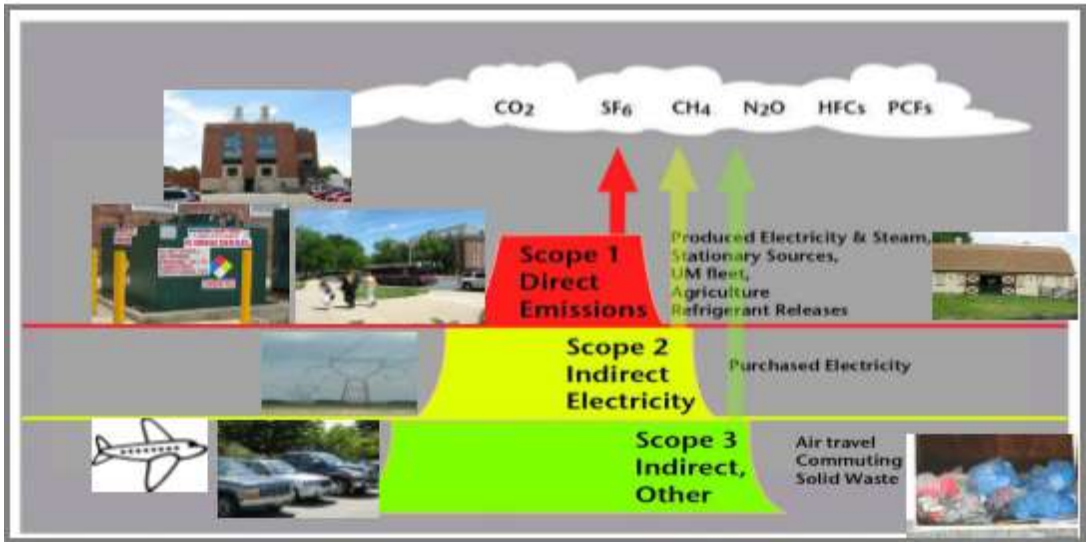
The whole world knows that Carbon is an essential element, and that we cannot go without it. Yet, there is a huge outcry on decarbonising. Why? The very essence of green auditing is to find answers to it - from our own environment.



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 Intergovernmental Panel on Climate Change (IPCC), as it comprises 76% or more of all greenhouse gases, globally. The release of CO_2 into the earth's environment through human activities is commonly known as carbon emissions and its total impact is called 'carbon footprint' [*Source: 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 contributes 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 any number of 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 in reality, more than sufficient to suggest 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 carbon footprints for many commonly used products is in effect a "complex job".

Take for example, the smart phones that is 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 Santhigiri in Thodupuzha 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 the immediate environment in a practical manner. We should not be using a 'cannon' for killing a fly.

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 NGGFn, therefore, is employing empirical measures that quantify the ecological footprint to a reasonable accuracy, and suggest simple remediation measures within the reach of the institution, that would neutralise 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 positives.

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 contended and be proud of.

Data Obtained from Component Audits

Component Audits in the foregoing Chapters 1 to 3 are the base elements under this Section.

These component audit findings give us the following data:

1. The area covering the higher education institution/college
2. The total number of persons (students, teachers, other members of staff, visitors including parents and guests) involved in normal functioning
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 and their origin
6. The amount of energy, water, food materials, stationeries etc. consumed
7. The amount 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 and their potential to remediate 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 approaches

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 CO_2, and of diesel as 2.68 kg CO_2.
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 is assumed to carry 50 passengers with the kilometreage 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 CO_2.
9. Carbon absorption capacity of semi-grown trees as 50% of that of full grown.
10. Carbon absorption of bush plants as varying widely according to the species. Certain bushes absorb as high as 49,000 gCO_2 per plant, whereas some others absorb as low as 150 g CO_2 per plant. As a general guide, the per-plant carbon absorption is assumed as 200 g CO_2.
11. The carbon absorption capacity of a 10-sq. ft. area of lawn is 1 g CO_2/day.
12. A person uses about 550 litre 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 the previous chapters.

1. Carbon Footprint due to energy use
   a) Electricity use including for water pumping, water purification and waste 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
   d) Biogas
   e) Micro Hydro Power & Other

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
   e) Phantom load reduction
   f) Other means

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

The CF calculated by these considerations (T CO_2 eqvt.) has to be brought into a Balance Sheet with remediation available and see how far it will compensate for the damages. The uncompensated part will indicate the Carbon Footprint.

Carbon Footprint Calculation for Santhigiri College of Computer Sciences, Thodupuzha, for 2021-'22

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)	2,294 kWh/month	27,528 kWh	22.6 T CO_2
1.b	Fossil fuel use	2.68 $kgCO_2$eq/kg 2.30 $kgCO_2$eq/L	- LPG (66x19+6x14)	- 1,338 kg	3.6 T CO_2
1.c	Firewood	1.65-1.8$kgCO_2$eq/kg	48 kg x 250d	12,000 kg	19.8 T CO_2
2.a	Food waste	1.9 $kgCO_2$eq/kg	18 kg x 300d	5,400 kg	10.3 T CO_2
2.b	Paper waste	1.725$kgCO_2$eq/kg	6 kgx250d	1,500 kg	2.6 T CO_2
2.c	Water waste	0.298$kgCO_2$eq/kL	15 Lx365L	5,520 L	1.6 T CO_2
2.d	Plastic/Other	6.0$kgCO_2$eq/kg	1.45x250	362.5 kg	2.2 T CO_2
3.a	Bus – students	2.68 $kgCO_2$eq/L	840x24x250d	25,876 L	69.3 T CO_2
3.b	Staff, Stu/week	2.68 $kgCO_2$eq/L	100x230x4/50x4	460 L	1.2 T CO_2
3.c	Cars, Taxis, and College Car	2.30 $kgCO_2$eq/L	200x250/10	5,000 L	11.5 T CO_2
3.d	Auto rickshaws	2.68 $kgCO_2$eq/L	LS		1.8 T CO_2
3.e	Two wheelers	2.30 $kgCO_2$eq/L	500x250/50 L	2,500 L	5.8 T CO_2
4	Events, Festivals	LS			10.0 T CO_2
5	Construction	Lump Sum	--		--
	Total				**162.3 T CO_2**

**No. of activity days in 2019-20: 200 days*

Table 4.1: Calculation of Carbon Footprint Source-wise

Remediation for Carbon Footprint – Santhigiri College of Computer Sciences, Thodupuzha for 2021 – '22

Sl No.	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	0.82 $kgCO_2$/kWh -- 1.34/kg --	25 kWx4x365 - - 3.5cum/day	36,500 kWh - 1277.5 kg	30.0 T CO_2 -- - - 14.7 T CO_2 -
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	300 LED Tubes x 40 W x 6h x 250	18,000 kWh	14.8 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		8 Bikes	LS	0.5 T CO_2
5	5.a. Greenery forest retained 5.b. Tree planting, Biodiversity 5.c. Gardens, Lawns etc.	Nil 22kg/yr. 2200 kg	LS		10.0 T CO_2
6	6. Walking & bicycle use	2.68 kg/L	135x250x2/50x4	637.5 L	1.7 T CO_2
7	7. Outreach activities	22 kg/yr	LS		8.0 T CO_2
	Total				**80.9 T CO_2**

Table 4.2: Remediation for Carbon Footprints: available/created

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

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

SANTHIGIRI COLLEGE OF COMPUTER SCIENCES
THODUPUZHA

Vazhithala PO, 685 583, Idukki, Kerala

Carbon Footprint Analysis and Evaluation for 2021-'22

The actual per capita carbon footprint for Santhigiri College, Vazhithala, Thodupuzha, Kerala is 107 kg (0.107 Ton) of CO_2 equivalent [162.3 Ton/(1506 + 14 visitors] during the current academic year. With an offset of 80.9 TCO_2 obtained through remedial actions, the net carbon footprint for 2021-'22 is thus [162.3 – 80.9 = 81.4 T CO_2 eq.].

The effective CF is 81.4/1520 or 0.054 T or 54 kg CO_2 per capita [2021-22]

According to the Economic Survey of Govt. of India, the per capita emission for an Indian is 1.84 T $CO_{2\ eq.}$ per annum in 2021. It is projected to increase by 1% in 2022.

For the year 2021-'22, for Santhigiri College, Thodupuzha, Kerala, the Carbon Footprint per capita at 0.054 T CO_2 equivalent, is very modest. This is achieved due to the minimal use of resources, maximal recycling, and moderate dependence on remedial measures like the use of solar energy.

The campus is a 'very low carbon footprint' institution, with potential for attaining Net Zero or Carbon Neutral with minimal efforts during the next two years.

The remediation gap between the assessed footprint and the available remediation is 81.4 Ton CO_2 eq. On a closer look, the major contributors are:

1. Transportation (89.6 T of CO_2)
2. Use of Purchased Electricity (22.6 T of CO_2), and
3. Wastes (16.7 T of CO_2)

The College may seriously consider more remediation options, in spite of its very low CF status. Being a college with moderate use of personal vehicles like the use of scooters/bikes, and cars, the present 55% share of carbon footprint of Transportation is largely due to large number of students daily commuting by bus, as it is situated distant from Thodupuzha.

The College maintains greenery through fruits and vegetable gardens, as well as tree plantations with reasonable biodiversity within the hilly terrain of the campus in the outskirts of Thodupuzha town. CF due to electricity use is more than fully offset by the Solar PV (30 gained against 22.6). It is planning to expand the solar PV power station by adding 25 kW more. Waste recycling and use as energy and manure is near total. Electronic wastes are stored properly and disposed of responsibly. For water, there is no dependence on any outside source.

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 as guidelines.

Strengths and Weaknesses:

- Human resources : Students, PTA, Staff, NGOs, Local people
- Physical resources : Location, land, buildings, equipment
- Financial : Grants, project funding, fees, and Govt. 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, State Govt., or other
- Funding sources : Governments, subsidies, donations, 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 administration 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 effort to bring down all the negatively weighing factors. For this,

- Decide on the directions that will be most effective to proceed with
- Assess possibilities and limitations for the intended change
- Identify barriers that will limit 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 again, just before implementing any 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. Attempt a *Miyawaki* model micro forest development
4. Strengthen College Database. Keep all required data on a weekly or monthly basis entered in appropriate Registers/Computer Folders. Students can help in this.

SWOT Matrix

for a "Greener Santhigiri College, Thodupuzha"

S	W
Strengths ➢ The college community practices a Green Protocol and the newcomers are encouraged to follow it ➢ Students are helping in having a litter free campus ➢ Rain Water Harvesting, Waste reduction, etc. are in line with the community's aspirations ➢ The Club Green Guardians and Bhoomithra sena are established and active ➢ Community links for outreach activities are strong	**Weaknesses** ∞ Due to location outside urban centres, several natural positives tend to weaken ∞ 65% of the students are available only during working hours, limiting their contributions ∞ Due to the wide variety of courses having different patterns of training, sensitization and awareness creation have to be in groups and specially arranged
O	**T**
Opportunities ❖ There is ample opportunity for expanding the use of renewable energy, for reducing or wiping off the carbon footprint ❖ There is enormous scope for improving energy efficiency in the campus ❖ Improvements to the rainwater harvesting set up through scientific planning can help in remarkable water management strategies ❖ Tree plantation with Biodiversity expansion as recommended by this green audit is acceptable to stakeholders. List of native plants obtained already	**Threats** ➢ The majority of students remain in the campus only for 2 or 3 years and so, repeating the campaigns and annual training sessions needed ➢ Having a large number of daily commuting students from outlying areas is boosting the transportation carbon footprint ➢ The increase in the types and quantum of e-wastes, for which safe disposal is yet not in sight, is a threat to be tackled locally ➢ Climate change impacts on a hillock can drive the community towards stringent water management measures

Nature's Green Guardians Foundation

Green Audit – Biodiversity Audit

Compliance Statement for AY 2021 - '22

Santhigiri College of Computer Sciences, Thodupuzha, 685 583 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.	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.	Ensured continuous guidance of experts from NGGFn and CED Thiruvananthapuram
	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.	Ensured [Vide 2021-22 Green Audit Report for the Green Protocol]
	3. Ensure that frequent training and awareness programs are planned and carried out focusing on climate change resiliency.	Done during the Audit year. Committed to Continue.
	4. Ensure that every student and staff member commit to the lowering of carbon footprint of the institution through sustained greening measures.	Staff and students are actively involved and continuing.
	5. Ensure that Environment Audit is conducted annually, with participation of staff and students, and that recommendations are followed up.	Annual Green Audit commitment ensured.

Prof. V K Damodaran
Ex-UNEP Expert
For NGGFn Audit Team, dated 14 December 2022

Nature's Green Guardians Foundation

Trivandrum 695 043 India

Biodiversity - Green Audit Certificate

Santhigiri College of Computer Sciences, Thodupuzha for AY 2021 - '22

This Green Audit including evaluation of Biodiversity conservation has been conducted for Santhigiri College of Computer Sciences, Vazhithala PO, Thodupuzha, 685583, 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 higher education institution before the audit team, 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.

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 the body of students undergoing studies in the College.

Green Audit 2021-'22 of Santhigiri College of Computer Sciences, Thodupuzha has found that the institution's per capita carbon footprint for the year is only 0.054 ton of CO_2 equivalent, a level well below the current 2021 national per capita average of 1.84 t CO_2, 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 even beyond the college boundary 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 NGGFn Audit, dated 14 December 2022

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.

Fr. Paul Parakkattel, Principal
Santhigiri College of Computer Sciences
Thodupuzha, Kerala
Date: 14 December 2022

Signature & Seal

PRINCIPAL
SANTHIGIRI COLLEGE OF COMPUTER SCIENCES
VAZHITHALA P. O., THODUPUZHA
KERALA, PIN : 685 583

SANTHIGIRI COLLEGE OF COMPUTER SCIENCES
THODUPUZHA KERALA 685 583
VAZHITHALA

Nature's Green Guardians Foundation

Green Audit – Energy Audit

Compliance Statement for AY 2021 - '22

Santhigiri College of Computer Sciences, Thodupuzha, 685 583 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.	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 course 3. 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 viable recommendations of the linked external expert energy agency.	Ensured continuous support and guidance from NGGFn headed by an International Energy Expert and with multidisciplinary expertise. [Ensured. Vide Section on Energy Efficiency and on Renewable Energy Use in the Green Audit Report of 2021-22.] Ensured. Vide Green Protocol in Green Audit Report of 21-22. Ensured. 2 Training programs organised. Energy Audit conducted and actions for 2022-23 in planning stage.

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Prof. V K Damodaran
Ex-UNIDO International Energy Consultant
For NGGFn Audit Team, dated 14 December 2022

Nature's Green Guardians Foundation
Trivandrum 695 043 India

Energy Audit Certificate

Santhigiri College of Computer Sciences, Thodupuzha for AY 2021-'22

Energy Audit for the period of academic year 2021-'22 has been conducted for Santhigiri College of Computer Sciences, Vazhithala, 685 583, Thodupuzha, 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 of the College.

Audit findings indicate that, of the 162.3 T CO_2 of actual carbon footprint of the institution for the year, the contribution from direct use of electricity and firewood was limited to 42.4 T CO_2. Transportation including public transport use (outside the campus) is at 89.6 T CO_2 (or 55% of the total). Wastes contributed 16.7 T CO_2. Wastes to energy thro' biogas has potential to be further strengthened as a remedial measure. Effective awareness and training programs were conducted during the year and are planned for the future as well, to make all stakeholders aware of the need for individual efforts.

Prof. V K Damodaran
Ex-UNIDO International Energy Expert
For NGGFn Audit, dated 14 December 2022

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.

Fr. Paul Parakkattel, Principal
Santhigiri College of Computer Sciences
Thodupuzha, Kerala

Date: 14 December 2022

PRINCIPAL
SANTHIGIRI COLLEGE OF COMPUTER SCIENCES
VAZHITHALA P. O., THODUPUZHA
KERALA, PIN : 685 583

Signature & Seal

SANTHIGIRI COLLEGE OF COMPUTER SCIENCES
THODUPUZHA KERALA 685 583
VAZHITHALA

Nature's Green Guardians Foundation

Green Audit – Environment Quality Audit

Compliance Statement for AY 2021 - '22

Santhigiri College of Computer Sciences, Thodupuzha, 685 583 Kerala

Overall Objective	Main Objectives	Compliance Status
Ensure that an effective environmental protection plan is followed in the campus with the maintenance of highest level of air quality, and 3 R 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.	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.	Ensured guidance from NGGFn and CED - having international environment, transportation, and energy management experts.
	2. Ensure that an Environment Protocol is adopted and followed by the campus community, adherence of which is reviewed annually.	Ensured. Green Protocol included in the Green Audit Report for the year.
	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.	Ensured. Training given. Regular work experience also ensured.
	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.	Commitment Ensured. Elaborate programmes for environment quality assurance is planned.
	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.	Ensured. Environmental Audit conducted and actions initiated for the next year. [Vide GA Report Ch. 5]

Prof. V K Damodaran
Ex-UNEP Expert
For NGGFn Audit Team, dated 14 December 2022

Nature's Green Guardians Foundation

Trivandrum 695 043 India

Green Audit – Environment Quality Certificate

Santhigiri College of Computer Sciences, Thodupuzha for AY 2021 - '22

Environment Audit for the academic year 2021 – '22 has been conducted at Santhigiri College of Computer Sciences, Vazhithala, 685 583 Thodupuzha, Kerala in accordance with the International Standards for ISO 14000 family of standards set by ISO TC 207 and its Sub-committees, Biological Diversity Act 2002, Environmental Protection Act 1986 (and amendments) of Government of India, and other relevant mandates for maintaining sustainable and healthy environment for education in the campus.

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 162.3 T CO_2 of carbon footprint of the institution for the year, the contribution from Transportation and mobility including public transport use is at 89.6 T CO_2 – with 25.8 T coming from the use of personal vehicles by staff and students, and that out of Wastes is at 17.3 T CO_2. The remedial activities contributed an overall relief of 80.9 T CO_2. The campus is maintained clean, and tidy, on a picturesque hill setting surrounded by raw rural land scape which is notably quiet and serene. Environmental Quality in the campus of 1400 plus students is GOOD.

Prof. V K Damodaran
Ex-UNIDO International Energy Expert
For *NGGFn Audit Team, dated 14 December 2022*

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.

Fr. Paul Parakkattel, Principal
Santhigiri College of Computer Sciences
Thodupuzha, Kerala

Date: 14 December 2022 Signature & Seal

PRINCIPAL
SANTHIGIRI COLLEGE OF COMPUTER SCIENCES
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SANTHIGIRI COLLEGE OF COMPUTER SCIENCES * VAZHITHALA * THODUPUZHA KERALA 685 583