Little Flower Institute of Social Sciences & Health (LISSAH)

26th Mile, Kaithapoyil PO, Kozhikode - 673 586 Kerala

GREEN AUDIT REPORT 2020 - '21

Nature's Green Guardians Foundation
Trivandrum 695 043

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Little Flower Institute of Social Sciences & Health (LISSAH)

26th Mile, Kaithapoyil PO, Kozhikode - 673 586 Kerala

Profile

LISSAH is a premier education institution under the management of St. Thomas Province of the Little Flower Congregation of the CST Fathers. Located at Kaithapoyil in the serene foot hills of Western Ghats in a picturesque setting, LISSAH was established in 2003. The college provides an excellent ambience for education, training and research in Social Work, Mental Health, Mental Health (Psychology) and other behavioural sciences. LISSAH offers Bachelor Degrees in Social Work (BSW), Psychology (BSc), English with Journalism and Audio Visual Communication (BA), Computer Science (BSc), and Masters Degree in Social Work (MSW), Psychology (MSc), Finance (MCom), Journalism (MAJMC) and English (MA). The key strength of learning at LISSAH is that teaching, research, consultancy, and field work are integrated to ensure the best possible learning environment for both the staff and the students.

LISSAH, ever since its establishment in 2003 has been making efforts to redesign the life of the people around the College, and to improve the quality of their life. LISSAH offers short-term training courses for employees of government and voluntary organizations on a number of relevant topics. It also undertakes action projects in the field of community development and community health in collaboration with a registered charitable society, viz., Health Dialogue Kozhikode, and this is the field lab of LISSAH. Furthermore, it provides professional expertise for training in field action projects, research, as well as policy analysis.

In 2017 the Institute is admitted as a Member of United Nations Academic Impact (UNAI). The very next year, LISSAH was rated as the Best Socially Responsible Educational Institute in Kozhikode District (Campuses of Calicut Award 2018).

LISSAH has taken as its responsibility the task of achieving holistic development for each and every one of its students. The numerous programmes organized under the initiative of various students' clubs and associations help in this. The Students' Associations organize also Arts Fest, Sports Day, College Day, and UN declared day celebrations at LISSAH. The NSS Unit in the college offers opportunities for outreach and social interactions. The students are encouraged to organize various off-campus programmes that enable them to understand the society they live in, and to get skilled in solving many of its lingering problems.

Little Flower Institute of Social Sciences & Health (LISSAH)

Vision

To give special attention for Rural development and
Empowerment of the marginalized

Mission

To improve the quality and dignity of human beings through training and research
So that the youth may become aware of the social realities and respond adequately
To create a better world where all people can co-exist in peace, justice, and happiness

Motto

Towards Life in its Fullness

At a Glance

LISSAH, Kaithapoyil, Kozhikode 673 586

I: General 1.1: General Particulars

o	Name of Educational Institution	:	Little Flower Institute of Social Sciences & Health (LISSAH). Affiliated to University of Calicut
o	Address	:	Kaithapoyil P O, Thamarassery, Calicut – 673 586 Kerala
o	Name of Local Body (Panchayat/ Municipality/Corporation)	:	Puthuppady Grama Panchayat
o	District	:	Kozhikode
o	Name and Designation of the Principal	:	Dr. Benny Joseph, *Associate Professor (Retd.)*
o	Phone number	:	9497 644 632
o	E-mail ID	:	principal@lissah.com
o	Name and Designation of the Contact (Teacher)	:	Rev. Fr. Niju Thalachira CST Director, LISSAH
o	Phone number	:	7025 385 135
o	E-mail ID	:	director@lissah.com
o	No of students selected for conducting the Survey and Data Collection (Green Guardians Club)	:	43

Basic Data

∞	Current Academic Year	:	2020-2021
∞	Total number of students in the College during the Current Academic Year (M+F)	:	156 m + 537 f = 693
∞	Total number of Teachers in the EI during the Current Academic Year (M+F)	:	16 m + 25 f = 41
∞	Total number of other Staff in the EI during the Current Academic Year (M+F)	:	5 m + 10 f = 15

Divyang-jan Particulars

↓	Number of differently-able (*Divyang-jan*) students, teachers, and other staff during the Current Year (M+F)	:	1 m + 0 f = 1

No.	Type of DP	No.	Gender	Age	Course studying
1	Locomotor disability	1	M	20	BSW 1st Year

1.2: Details of Land and Buildings

Building/Block	Utility	Plinth Area (Sq. m.)	No. of Floors	Roofing: Concrete: Flat/Sloppy, Tiled, Sheet
↓ Office Block	Academic	1,642 sq. m.	3	Concrete Sloppy + Conc. Flat + Tiled
↓ Auditorium	Assembly	2,300 sq. m.	3	Concrete Flat
↓ Library Block	Academic	2,628 sq. m.	3	Concrete Flat
↓ Play Ground	Sports	4,000 sq. m.	--	

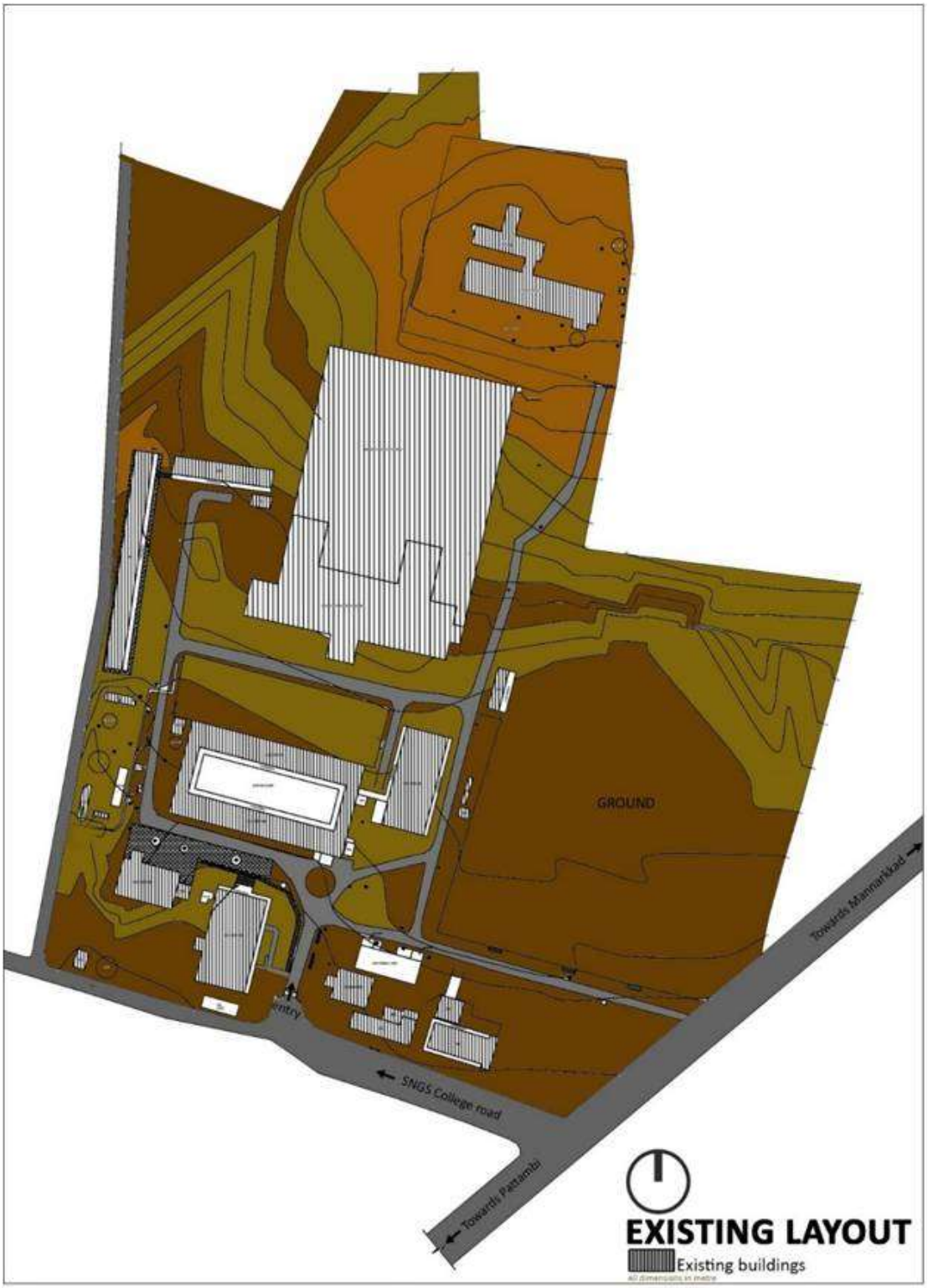
↓	Total Area of the Campus (ha)	:	7.28 ha
↓	Area of Playground (ha)	:	0.40 ha
↓	Area under open air Auditorium (ha)	:	0.05 ha
↓	Area on Agriculture/Gardening (ha)	:	1.21 ha + 2.98 ha (new)
↓	Barren Area (ha)	:	0.26 ha
↓	Area: Other purposes (specify) (ha)	:	0.00
↓	Area under Tree cover (ha)	:	5.36 ha (includes 2.98 of new garden)

Little Flower Institute of Social Sciences & Health

Campus Layout

Ariel view of the LISSAH Campus

How to reach LISSAH.



LISSAH Campus Layout

Executive Summary

This Green Audit Report of the campus of Little Flower Institute of Social Sciences & Health (LISSAH), Kozhikode district, Kerala, is prepared in a lucid form that will help even a first year student to comprehend the ecological and ethical values of learning at this institution, as well as to get reminded on how each student can contribute to the greening initiatives of the College community. The details on the various aspects of life and learning in LISSAH covered by this report will go a long way towards our Nation moving fast to achieve carbon neutrality. In India, Green learning is a right, and at the same time a responsibility.

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

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

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. Little Flower Institute of Social Sciences & Health, decided to have a comprehensive green audit by a multidisciplinary expert group, and also to train a selected group of students and teachers on the principles and procedures of green audit, so that the 'shade of green' it has painted already can be deepened further aiming at 'carbon neutrality' at the earliest.

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

Green Audit is undoubtedly the best route for grappling with the fast changing situations. Green Audit is also a useful tool to know how and where an institution is using the most of energy, water, and other resources. The audited education institution can thus plan for the needed changes to ensure that resources are utilised only sustainably.

The Green Audit process at LISSAH for 2020-'21, even with looming COVID-19 threats, therefore involved the getting together of environment conscious student groups – 4 of them 43 in total strength - in the form of 'Club Green Guardians', and guiding them to take responsibility for energising the entire community into greening.

The results showed that, the Little Flower Institute of Social Sciences & Health briefly spoken as LISSAH at Kaithapoyil, Kozhikode district, is very close to attaining carbon neutral state, provided it lays more emphasis on the suggestions on CF remediation. There is enough room for taking the energy system to near total efficiency. Commitment of all concerned has already helped in maintaining a healthy environment as indicated by the very low *effective per capita carbon footprint during 2020-'21 at just 0.198 T CO_2 eq., compared to the per capita national average of 1.84 T CO_2eq. Deliberate efforts have been made to conserve and further nurture the green resources. For e.g.: improved the useful yield of fresh water sources through successful rainwater harvesting, maintained more than half of the 7.28 ha campus land as gardens and natural vegetation, etc.*

The Audit has made a number of observations in the respective chapters on component audits, to embrace speedier routes to reach carbon neutrality within a shorter target period. If followed further, LISSAH can be the best in the district within a short period.

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, 695035. Dated: 22.01.2022

The Green Audit Team 2020 -'21 for Little Flower Institute of Social Sciences & Health

Dr. Benny Joseph, Principal, *LISSAH*
Rev. Fr. Niju Thomas Thalachira CST, Director, LISSAH
Mr. Shiju Elias, *Asst. Professor*
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Ms. Nimisha K George, *Asst. Professor*
Mr. Subin Varghese, *Asst. Professor*
Mr. Geo Kappen, *Asst. Professor*
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Prof. V K Damodaran, *Chairman, NGGFn*
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Dr C Jayaraman, *Director, EQUINOCT*
Er A M Narayanan, *Former Director, ANERT*
Mr Hari Prabhakaran P S, *ISO 14001 Lead Auditor*
Er K Madhukrishnan, *CEO, Herbal Heritage Homes*
Mr Ramkamal Manoj, *Managing Trustee, Chakshumathi*

Little Flower Institute of Social Sciences & Health
Campus Green Protocol

This Green Initiative is to Invigorate
the students, teachers, and all other stakeholders of LISSAH
into activities to enhance the sustainability of
its educational and environmental landscape with total dedication

We, the stakeholders of LISSAH, Kaithapoyil, Kozhikode at all times will

1. Encourage institutional practices, and personal behaviour that foster and improve health of our community.
2. Maintain the campus as 'plastic averse' by distancing from the use of banned plastic materials, plastic wrapped bouquets, plastic bags, flex banners, plastic water bottles, paper cups, and plastic wrappers - and also our homes, likewise.
3. Enable reduction in the use of fossil fuel for transport, cultivate the habit of vehicle sharing, and e-mobility, as also depend more on public transport.
4. Enforce water conservation, extend rainwater harvesting, as well as recycling and reuse of gray water, and educate the community around - on climate change and ways of impeding its impacts on people's lives and livelihoods.
5. Enhance sustainability in land-use and constructions.
6. Promote the use of renewable energy sources, reduce energy losses, and replace devices with modern energy efficient gadgets at every opportunity.
7. Resort to e-notices, e-banners, and e-publicity - digital slides for presentations included - to reduce material use and environmental pollution.
8. Practice energy extraction from wastes, through affordable technologies like biogas or bio-CNG production.
9. Keep non-biodegradable wastes and e-wastes stored clean and dry separately based on its nature, and hand it over for disposal only to the local body, or to a competent agency.
10. Ensure that self-operative incinerators and self-disposing napkin receptacles are ready and operative 24x7 in the Amenity Centres for Ladies in the campus.

All stakeholders accept the moral responsibility on keeping the premises at all times as "Waste-free, Clean, and Green"
and
Evaluated periodically through
Annual Green Audits

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Green Audit 2020–'21: Procedures and Priorities

The Institute management, teachers and the students are committed to keeping the premises as a "Green Campus", and is contributing towards environmental conservation and sustainable development. The college administration works on several facets of improving the "Green Campus" - including Water and Energy Conservation, Tree Plantation, Waste Management, Community Outreach, Social work, and enriching the campus biodiversity.

Towards Detailed Green Auditing

Maximizing the performance efficiency through conservation is the broad objective of the management. The 'green auditing' is done for the academic year 2020 -'21, even though the COVID-19 pandemic partially disrupted the regular routines of teaching and learning throughout the academic year. The stakeholders of this centre of learning and training agree to ensure the following:

1. Enhancement and coordination among various activities of the institution with importance given to ecological considerations and resources conservation;
2. Institutionalizing all good practices initiated as part of review of activities;
3. Driving a strong decision-making approach on the basis of 'life cycle cost' analysis on institutional issues; and
4. Acceptance of a dynamic system for functional and lifestyle changes by the institution's stakeholders including the students.

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

The Procedures and Priorities:

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

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

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

Little Flower Institute of Social Sciences & Health (LISSAH)

Campus Population in 2020 -'21

Category	Male	Female	Transgender	Total
Students	156	537	Nil	693
Teaching Staff	16	25	Nil	41
Non-Teaching Staff	5	10	Nil	15
Total for 2020-21	**177**	**572**	**0**	**749**

Programmes during 2020 -'21

I	Post Graduate Programmes
1	M A (English)
2	M SW (Social Work)
3	M Sc (Psychology)
4	M A (JMC)
5	M Com(Commerce)
II a	Undergraduate Programme BA
1	B A (English)
2	B SW (Social Work)
II b	Undergraduate Programme BSc
3	B Sc (Psychology) – 2 batches
4	B Sc (Computer Science)
III	Other Programmes (Certificate Programmes offered)
1	Fundamentals of Google products and Office Automation
2	Competent Skills for Professionals
3	MS Office
4	Personality Development and Life Skills acquisition (Star Project)

1. Audit on Green Campus Initiatives

1.1. Campus Trespass Restrictions

The Little Flower Institute of Social Sciences & Health (LISSAH) established in 2003, situated in the foot hills of Western Ghats at Kaithapoyil (26th mile) in Kozhikode district, 40 km from Kozhikode (Calicut) City close to Kozhikode – Mysore - Bengaluru National Highway (NH 766) in a serene and picturesque settings is known to local people as a safe campus, very conducive to the youth for serious study. It is a mixed education institution with 693 students, and is easily accessible from all directions, especially from Kozhikode, Malappuram and Wayanad districts. The entry to the campus is controlled through the main gate, which is secured with guards 24/7.

There is no possibility of any trespass, and there are no multiple free entry provisions for the Institute academic area. For new visitors, guidance from the security staff is available for movement without distracting the students from their academic work. In general, the campus is safe and secure.

1.2. Use of Bicycles and EVs

LISSAH campus being situated in a hillside rural village with highly undulating terrain and since most of the students are coming from long distance, use of bicycles for commuting to college is unthinkable. The roads even though not with very heavy traffic, are not having proper walkways and therefore, bicycle riding is not a comfortable exercise here. Kerala being of high population density, with many roads lacking continuous and wide enough footpath or cycle tracks, parents also shun bicycle use for their wards.

Many roads even in city corporations in Kerala are without continuous footpath having obstacle free walkways and cycle tracks. It is also well known that Kerala is on top of Indian states having higher population density. Therefore, students do not consider roads for bicycling as safe.

The number of registered motor vehicles in Kerala is over 15 million for a population of 35 million, and the annual road accidents reported in Kerala are over 40,000. Fatal road accidents every year takes away nearly 4,000 lives. These facts influence the parents while approving the choice of mode of travel to the collegegoing children. However, nearly 10 million powered 2-wheelers are on the roads in Kerala, used by students, and young working population, particularly women. As regards LISSAH, there are 60 powered two wheelers, in shared use by 82 students/staff.

1.3. Pedestrian Friendly Pathways

LISSAH campus is carefully planned to accommodate all necessary buildings, playgrounds, internal roads, hostels, living areas, etc. well-connected, and leaving sufficient areas for gardening, greening, and for shaded pathways linking the different activity areas. The campus is beautifully landscaped with lawns and bushy trees in all the vacant areas. The total lawn area comes to around 0.35 ha.

Passage ways are wide, clean, and shaded


Pedestrian friendly Landscape

The pathways are ideal for gentle strolling or hurried jogging. There are several trees having distinctly dense and large canopy, dotting the 7.28 hectare campus. Motor vehicle movements are not needed generally in the academic area; therefore, students can move carefree. The pathways are interlock tiled/tarred and regularly cleaned, making it possible for students and the staff members to move freely, even with gentle discussions. The Audit found the campus as very safe and hassle-free, for a rewarding learning environment.

1.4. Plastic Free Campus

The students, teachers, and all other stakeholders at LISSAH are committed to keeping all kinds of plastics at bay; especially the single-use type of plastics or other plastics-containing materials at all times. They seriously adhere to the Campus Green Protocol (page 13), which is in line with the suggestions of the highly environment conscious Kerala higher education department. The Audit also 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 approached their own homes and their neighborhoods, to enlist support for their campaign to avoid plastics completely, and embrace Kerala's 'Green Philosophy'.

Beyond keeping the campus as plastic free, the students have gone a step further and engaged themselves in a campaign, wherein students in small groups go to the nearest Thamarassery town as well as to colonies around and in broad daylight, pick up plastics, cartons etc., which people are tempted to carelessly eject into the public places and kerbs.

The Audit team could not find plastics strewn around anywhere in the campus during the audit visits. The students, teachers and others are agreeable to eliminate plastic water bottles, plates, etc., and have turned to safer substitutes. This has sent the right message to the public as well as to their own families. The road to the Institute Library can be seen next.

1.5. Landscaping and Gardening

The LISSAH campus is a green canvas, and is truly a temple for the young students to worship ecological practices, and learn how to keep one's environment aesthetically pleasant - green, clean, and waste free. Soon after joining, the students receive messages on how to 'Nurture the Nature'. The campus is rich in its floristic composition. In addition, the campus has places under the tree canopies, with plants around, and such other escapades for the tired minds to relax and rejoice at various parts of the campus.

Various trees planted in the campus not only gives fruits for people and animals but also provide shade for people to walk or sit below the trees. It is supplemented with beautifully landscaped garden with grass and green shrubs. More than 60% of campus area of over 7 ha land is now planted with various trees and plants - an activity in which the Club Green Guardians, Nature Club, NSS and other students are interested.

The residential areas (Hostels etc.) practice integrated organic farming along with animal rearing (cow, hen, etc.) and using the cow dung for biogas and vegetable cultivation. Lawns are maintained well, vacant areas are converted into fruit and nut garden, flowering plants are introduced to the extent possible, and as seen from the aerial view, all the buildings are fortressed with native trees. Campus residents including the staff are involved in maintaining the campus as soothing as possible to the eyes of the students and visitors.

Campus Biodiversity

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

2.1. Biodiversity (Green Cover) Audit

Background

In order to create awareness among the people on the importance of conservation of biodiversity, at local level. Biodiversity is essential for human existence. Yet, as of now biodiversity is an area of major concern all over the world. This is mainly because of the worldwide destruction of world's biodiversity at alarming rates. The threat to biodiversity is now more than ever before in human history. Nature and its vital contributions to the living world are deteriorating worldwide, according to a number of serious study reports such as CBD 2020; WWF 2020; IPBES 2019; and EEA 2019). Emerging devastating infectious diseases are of current societal concern given the persistent 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 said to be the main causes of biodiversity loss. The Little Flower Institute of Social Sciences and Health (LISSAH) is located at 11˚29′10″ N latitude and 75˚59′35″ E longitude, in Kaithapoyil, Kozhikode district, Kerala. The Institute campus with an area of 7.28 ha is situated in the foothills of Western Ghats at an altitude of around 40 m above MSL.

The campus with lush green vegetation on a hillock is attracting students due to several reasons. The emphasis given to conservation of nature within the campus which is lying close to the reserve forest areas of the Western Ghat Biodiversity Hotspot is certainly one among those reasons. The main stakeholders viz., the students are very much conscious of the need to maintain the green surroundings where they are to spend time learning, and therefore, they are assisting in this task with their efforts.

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 newly joining students about the need for conservation of the biodiversity and protecting the green areas in the campus by involving themselves in the participatory data collection activities. By providing hands-on training to a group of students and staff on collecting data related to biodiversity of the campus, and calculating the Carbon sequestration potential of the green vegetation will help in creating awareness on the role of biodiversity and ecosystems in mitigating the

impacts of climate change. In addition, these areas facilitate the health and well-being of the people by alleviating stress and enabling relaxation.

The vegetation and soil of a greenspace can, not only sequester Carbon, directly contributing to a reduction in atmospheric CO_2 concentration, but also can affect the carbon balance indirectly, through their effects on the energy balance and thus on CO_2 emissions related to energy use. The maximum benefit of these spaces largely accrues from the 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 LISSAH campus by involving the students and staff, and to prepare 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 as well as its role in mitigating the climate change impacts.
- To make the students capable of dealing with environmental and ecological issues arising to their immediate surroundings.
- To conduct a rapid survey on the actual biodiversity composition of the campus and to list out the species present.
- To find out the carbon sequestration potential of trees and other vegetation in the campus.
- To find out potential areas for Eco restoration within or outside the campus and frame future interventions.
- To provide recommendations for future activities with respect to the scientific documentation of the campus biodiversity and activities to make the campus more biodiversity rich, by involving students and faculty members.

Methods

Vegetation plays an important role in the reduction of carbon dioxide from atmosphere by 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 growing trees is the carbon storage. 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 50% carbon.

Student Green Guardians getting ready to take tree stats

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 are identified by the expert group.

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

Students in the field

The data collected and tabulated were compiled by the expert team, and based on the data, the following analyses were made using standard procedures:

1. Botanical identity of plants collected with common names
2. Status of plants based on its origin/distribution
3. Total number of 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 metre is taken)
5. Total carbon dioxide sequestrated by the trees so far is arrived by
    a. Calculating the above ground biomass (AGB) of each tree using simple allometric equation mixed tree species stands - **$AGB= (0.18D^{2.16})*1.32$** (Brahma B,2021)
    b. The below ground biomass (BGB) is taken as 26% of AGB (Cairns et al. (1997))

c. Carbon content of trees is assumed as 50% of its Total biomass, from which CO_2 equivalent is found out by multiplying it with 44/12.

6. The annual carbon sequestration potential is roughly estimated by using the following assumptions:
    a. A Dicot tree sequestrates on average 22 kg of carbon dioxide/year.
    b. Coconut Palm sequesters around 10 kg of CO_2 per year
    c. Areca nut and other Palms sequester around 4 kg of CO_2 per year
    d. One Bamboo culm will sequester 3 kg of CO_2 per year
    e. One hectare of organic vegetable cultivation can sequester net 2 ton carbon dioxide. This is based on a recent study (Sardiana, 2021). 1 ha organic farming add around 1.13 t of net carbon to the soil/year which is equivalent to around 4t CO_2, allowing 50% emission potential during planting operations.
    f. One sq. m. of organic lawn can add around 150g of net carbon to the soil/year (Zirkle et al., 2011) which is equivalent to around 550g CO_2.

Findings on Campus Floristic Diversity

The rapid assessment of the floral diversity of the campus revealed the following: There are 224 species of phanerogamic plants identified from the campus, of which 176 are Dicots, 45 Monocots, and 3 Gymnosperm.

- Out of the 224 species present in the campus, 65 are herbs, 45 shrubs including one parasitic shrub, 33 climbers and the remaining 81 are trees. This shows high diversity of tree species in the campus.
- Out of the 224 taxa identified, 94 are exotic plants and 130 are native/indigenous plants. Highest number of exotics are found in trees (43 out of 81).
- 140 species are cultivated plants and the remaining 84 are growing wild.

- The entire plants are coming under 67 families (53 dicot, 11 monocot and 3 Gymnosperm).
- The highest species diversity is in the family Fabaceae (21 species) followed by Poaceae (19), Euphorbiaceae (12) Rubiaceae (11) and Moraceae (10). Apocynaceae & Myrtaceae (8 each), Araceae, Arecaceae & Asteraceae (7 each), Combretaceae, Malvaceae, Solanaceae & Verbenaceae (6 each), and Cucurbitaceae & Convolvulaceae represented by 5 species each. 35 families are represented by only 1 species, 8 with 2 species, 5 with 3 species, and 4 with 4 species.
- It is worth mentioning that 149 taxa (66.5%) present in the campus are used in one or many of Ayush medicine branches as detailed in the table 2.1.1. The contents from 9 taxa are also used in modern medicine.
- 7 species found in the campus are highly invasive in nature (*Camonea vitifolia, Combretum indicum*, *Ipomoea cairica, Lantana camara, Mikania micrantha, Mimosa diplotricha, and Pueraria phaseoloides*) and they may threaten the local biodiversity.

A detailed account on the results of rapid assessment of the floral diversity of the campus is given in table 2.1.1.

Table 2.1.1: Floristic Diversity of LISSAH Campus

Sl. No.	Botanical Name	Local/Eng. Name	Habit	Status	Habitat	Medicinal Use (System)
DICOTYLEDONS						
Acanthaceae						
1	*Asystasia gangetica (L.) Anders.*	Upputhali	Herb	N	W	Ayurveda, Siddha, Folk
2	*Dipteracanthus prostratus (Poir.) Nees*	*Thuppalampotti/* Bell Weed	Herb	N	W	Ayurveda, Folk
3	*Justicia adathoda L.*	Adalodakam/ Malabar nut	shrub	N	W	Ayurveda, Siddha, Unani, Folk, Rigpa, Homeopathy, Sowa Chinese, Modern
4	*Thunbergia grandiflora (Roxb. ex Rottl.) Roxb.*	Blue trumpet vine	Climber	N	C	Folk, Chinese
Amaranthaceae						
5	*Aerva lanata (L.) Juss. ex Schult.*	*Cherula/*Mountain knotgrass	Herb	N	W	Ayurveda, Siddha, Folk
6	*Alternanthera sessilis (L.) R. Br. ex. DC.*	Ponnamkannicheera/ Sessile joy weed	Herb	N	W	Ayurveda, Siddha, Folk, Sowa Rigpa, Chinese
7	*Amaranthus viridis L.*	Kuppacheera	Herb	N	W	Ayurveda, Siddha, Folk, Chinese
8	*Gomphrena globosa L.*	*Vadamalli/* Globe amaranth	Herb	E	C	Folk, Sidha
Anacardiaceae						

Sl. No.	Botanical Name	Local/Eng. Name	Habit	Status	Habitat	Medicinal Use (System)
9	*Anacardium occidentale L.*	Parangimavu/ Cashew Tree	Tree	E	C	Ayurveda, Siddha, Folk, Homeopathy, Chinese
10	*Mangifera indica L.*	*Mavu*/ Mango Tree	Tree	N	C	Ayurveda, Siddha, Unani, Homeopathy, Folk, Tibetan, Veterinary
Annonaceae						
11	*Annona muricata L.*	*Mullatha*/Soursop	Tree	E	C	Siddha, Folk
12	*Annona squamosa L.*	*Atha*/ Custaed apple	Tree	E	C	Ayurveda, Siddha, Unani, Folk
13	*Monoon longifolium (Sonn.) B.Xue & R.M.K.Saunders*	*Arana maram*/ Indian mast tree	Tree	N	C	Ayurveda, Siddha, Folk
Apocynaceae						
14	*Allamanda cathartica L.*	*Kolambichedi*/ Allamanda	Climber	E	C	
15	*Alstonia scholaris (L.) R. Br*	Ezhilampla/ Devil tree	Tree	N	W	Ayurveda, Folk, Homeopathy, Tibetian, Unani and Sidha
16	*Catharanthus roseus (L.) G. Don*	Nithyakalyani/ Periwinkle	Herb	E	C	Ayurveda, Folk and Modern
17	*Hemidesmus indicus (L.) R. Br*	*Naruneendi*/ Indian sarsaparilla	Herb	N	W	Ayurveda, Folk, Tibetian, Unani, Sidha
18	*Nerium oleander L.*	*Arali*/ Oleander	shrub	E	C	Ayurveda, Homeopathy, Folk, Veterinary
19	*Plumeria rubra L.*	*Ezhachampakam*/Frangipani	Tree	E	C	Ayurveda, Siddha, Folk
20	*Tabernaemontana alternifolia L.*	Koonanpala	shrub	N	W	Ayurveda, Folk
21	*Tabernaemontana divaricata (L.) R. Br.*	Nadyarvattam/ East India rosebay	shrub	N	C	Ayurveda, Folk
Asteraceae						
22	*Chromolaena odorata (L.) King & Robins*	Communist pacha/ Siam weed	shrub	E	W	
23	*Elephantopus scaber L.*	Anachuvadi/Prickly leaved elephant's foot	Herb	N	W	Ayurveda, Sidha, and Folk
24	*Emilia sonchifolia (L.) DC.*	Muyalcheviyan/ Lilac tassel flower	Herb	N	W	Ayurveda, Folk, and Sidha
25	*Mikania micrantha Kunth*	Vayara/ Bitter vine	Climber	E	W	
26	*Tagetes erecta L.*	*Banthi*/ Marigold	Herb	E	C	Ayurveda, Siddha, Folk, Chinese
27	*Tridax procumbens L.*	Kumminipacha/ Coat-button	Herb	E	W	Ayurveda, Siddha, Folk
28	*Wedelia trilobata (L.) A. S. Hitchc*	Amminippov/ Trailing daisy/ Singapore daisy	Herb	E	W	
Balsaminaceae						
29	*Impatiens balsamina L.*	*Balsam*	Herb	N	C	Ayurveda, Unani, and Sidha

Bromeliaceae						
30	*Ananas comosus (L.) Merr*	*Kaithachakka* Pineapple	Herb	E	C	Ayurveda, Siddha, Unani, Folk, Modern
Caricaceae						
31	*Carica papaya L.*	Pappaya	Tree	E	C	Ayurveda, Siddha, Unani, Folk, Chinese, Homeopathy, Modern
Casuarinaceae						
32	*Casuarina equisetifolia L.,*	*Kattadi/* Beach she-oak	Tree	E	C	Folk, Sidha
Chenopodiaceae						
33	*Spinacia oleracea L.*	*Seemacheera/* Spinach	Herb	E	C	
Clusiaceae						
34	*Garcinia mangostana L.*	*Mangosteen*	Tree	E	C	Ayurdveda, Sidha
Combretaceae						
35	*Calycopteris floribunda Lam.*	Pullaini	Climber	N	W	Ayurveda, Folk
36	*Combretum indicum (L.) DeFilipps*	*Thookuchethi/* Rangoon creeper	Climber	E	W	Siddha, Folk, Chinese, Modern
37	*Terminalia arjuna (Roxb. ex DC.) Wight & Arn.*	*Neermarathu/pulimatti/* Arjun tree	Tree	N	C	Ayurveda, Siddha, Unani, Homeopathy, Sowa Rigpa, Folk
38	*Terminalia bellirica (Gaertn.) Roxb.*	*Thanni/* Terminalia bellirica	Tree	N	C	Ayurveda, Siddha, Unani, Folk
39	*Terminalia catappa L.*	*Adamaram/Badam* /Indian-almond	Tree	E	C	Ayurveda, Siddha, Unani, Folk
40	*Terminalia paniculata Roth*	Maruth/ Flowering murdah	Tree	N	W	Ayurveda, Siddha, Folk
Convolvulaceae						
41	*Argyreia nervosa (Burm.f.) Bojer*	Samudrappacha/Elephant creeper	Climber	N	W	Ayurveda, Siddha, Unani, Folk, Sowa Rigpa
42	*Camonea vitifolia (Burm.f.) A.R.Simões & Staples*	Manjavayaravalli	Climber	E	W	
43	*Erycibe paniculata Roxb.*	Erumathali/ Panicled Erycibe	Climber	N	W	Ayurveda, Folk
44	*Hewittia malabarica (L.) Suresh*	Ohanamvalli	Climber	N	W	
45	*Ipomoea cairica (L.) Sweet*	Cairo Morning glory	Climber	N	W	
Cucurbitaceae						
46	*Coccinia grandis (L.) Voight,*	Koval/ Kowai fruit	Climber	N	C	Ayurveda, Homeopathy and Sidha
47	*Diplocyclos palmatus (L.) Jeffrey*	Neyyunni	Climber	N	W	Ayurveda, Folk
48	*Momordica charantia L.*	*Pavaikka/* Bitter Gourd	Climber	N	C	Ayurveda, Siddha, Unani, Folk, Tibetan, Veterinary, Chinese
49	*Trichosanthes anguina L.*	Padavalam/ Snake gourd	Climber	N	C	Ayurveda, Siddha, Sowa Rigpa

50	*Zehneria maysorensis (Wight & Arn.) Arn.*		Climber	N	W	
Elaeocarpaceae						
51	*Muntingia calabura L,*	*Pancharappazham/* Birds cherry	Tree	E	C	
Euphorbiaceae						
52	*Breynia androgyna (L.) Chakrab. & N.P.Balakr*	*Velicheera/* Chikurmanis	shrub	N	C	Siddha, Folk
53	*Cnidoscolus aconitifolius (Mill.) I.M.Johnst.*	Chayamansa/ Mexican Cheera	shrub	E	C	Folk
54	*Codiaeum variegatum (L.) A.Juss.*	*Kozhivalan/* Garden croton	shrub	E	C	
55	*Euphorbia pulcherrima Willd. ex Klotzsch.*	Poinsettia, Christmas flower	shrub	E	C	
56	*Excoecaria cochinchinensis Lour.,*	*Chinese croton*	shrub	E	C	
57	*Hevea braziliensis (Willd. ex A. Juss.) Muell.-Arg.*	Rubber tree	Tree	E	C	
58	*Macaranga peltata (Roxb.) Muell.-Arg.*	Vatta	Tree	N	W	Sidha, Folk
59	*Manihot esculenta Crantz.*	Maracheeni/ Tapioca	shrub	E	C	Ayurveda, Siddha, Homeopathy
60	*Phyllanthus acidus (L.) Skeels*	*Arinelli/* Star Gooseberry	Tree	E	C	Ayurveda, Siddha, Folk
61	*Phyllanthus amarus Schum. & Thonn.*	*Keezharnelli/* Gale of the wind	Herb	N	W	Ayurveda, Siddha, Folk, Sowa Rigpa
62	*Phyllanthus emblica L.*	*Nelli/* Indian gooseberry	Tree-Dicot	N	C	Ayurveda, Siddha, Unani, Folk, Chinese
63	*Tragia involucrata L.*	Choriyanam/ Indian stinging nettle	Herb	N	W	Ayurveda, Siddha, Folk

Fabaceae						
64	*Bauhinia variegata L.*	*Chuvanna Mandaram/* Mountain ebony	Tree	E	C	Ayurveda, Siddha, Folk, Chinese
65	*Caesalpinia pulcherrima (L.) Swartz,*	*Rajamalli/* Peacock Flower	shrub	E	C	Ayurveda, Siddha, Folk, Chinese
66	*Cassia fistula L.*	Kanikonna/ Golden shower tree	Tree	N	C	Ayurveda, Folk, Tibetian, Unani and Sidha
67	*Clitoria ternatea L.*	*Sankupushpam/* Asian pigeonwings	Climber	E	C	Ayurveda, Folk, Tibetian, Unani and Sidha
68	*Crotalaria juncea L.*	Kilukki / Bengal Hemp	Herb	N	W	Ayurveda, Folk, Unani and Sidha
69	*Dalbergia latifolia Roxb*	Eetti/ Rose wood	Tree	N	C	Ayurveda, Siddha, Folk
70	*Erythrina stricta Roxb*	Murikk/ Indian Coral tree	Tree	N	C	Ayurveda, Folk and Sidha
71	*Gliricidia sepium (Jacq.) Kunth ex Walp*	*Seema konna/* Spotted Gliricidia	Tree	E	W	

72	*Hultholia mimosoides (Lam.) Gagnon & G.P.Lewis*	*Komullu*	Climber	N	W	Siddha, Folk
73	*Libidibia coriaria (Jacq.) Schltdl.*	*Dividivi plant/* American sumac	Tree	E	C	
74	*Mimosa diplotricha C. Wight ex Sanvalle*	*Aanathottavad/* Giant Sensitive plant	Climber	E	W	
75	*Mimosa pudica L.*	*Thottavad/* Shame plant	Herb	N	W	Ayurveda, Siddha, Folk, Tibetan, Chinese
76	*Peltophorum pterocarpum (DC.) Backer ex Heyne*	*Charakonna/* Yellow Flame Tree	Tree-Dicot	E	C	Siddha, Folk
77	*Pongamia pinnata (L.) Pierre*	*Pongilyam- Ungu/* Indian beech tree	Tree-Dicot	N	C	Ayurveda, Siddha, Unani, Folk, Tibetan, Chinese
78	*Pueraria phaseoloides (Roxb.) Benth.*	Thottapayar	Climber	N	W	
79	*Racosperma auriculiforme*	Acacia	Tree	E	W	
80	*Saraca asoca (Roxb.) de Wilde*	*Ashokam/* Ashoka tree	Tree	N	C	Ayurveda, Siddha, Homeopathy, Folk
81	*Senegalia caesia (L.) Maslin, Seigler & Ebinger*	*Incha/* Soap bark	Climber	N	W	Ayurveda, Folk
82	*Sesbania grandiflora (L.) Poir.*	Agasthi cheera	Tree	E	C	Ayurveda, Siddha, Unani, Folk, Tibetan
83	*Tamarindus indica L.*	*ValanPuli/* Tamarind	Tree	E	C	Ayurveda, Siddha, Unani, Folk, Tibetan, Chinese
84	*Vigna unguiculata (L.) Walp.*	*Payar/* Yardlong bean	Climber	N	C	Ayurveda, Unani, Folk, Sowa Rigpa, Chinese
Flacourtiaceae						
85	*Flacourtia jangomas*	Loulokia/ Puneala plum	Tree	N	C	Ayurveda, Siddha, Unani
Hippocrateaceae						
86	*Loeseneriella africana var. obtusifolia (Roxb.) N.Hallé*	Puramkodi	Climber	N	W	
Lamiaceae						
87	*Leucas aspera (Willd.) Link*	*Thumba/* Leucas	Herb	N	W	Ayurveda, Siddha, Homeopathy, Folk, Veterinary
88	*Ocimum gratissimum L.*	Ramathulasi/ Lemon basil	Herb	N	C	Ayurveda, Siddha, Unani, Homeopathy, Folk, Veterinary
89	*Ocimum tenuiflorum L.*	Krishnathulasi/ Holy Basil	Herb	N	C	Ayurveda, Siddha, Unani, Homeopathy, Folk, Tibetan, Chinese
Lauraceae						
90	*Cinnamomum verum Presl*	*Karuva/* Cinnamon tree,	Tree	N	C	Ayurveda, Folk, Homeopathy, Tibetian, Unani and Sidha
91	*Persea americana Mill.*	*Vennappazham/* Avocado Pear	Tree	E	C	
Lecythidaceae						
92	*Couroupita guianensis Aublet*	*Nagalingamaram/* Cannon ball tree	Tree	E	C	

Loranthaceae						
93	*Dendrophthoe falcata (L. f.) Etting.*	Itthikanni/ Mistletoe	Parasitic shrub	N	W	Ayurveda and Folk
Lythraceae						
94	*Lagerstroemia speciosa (L.) Pers.*	Manimaruth/ Pride of India	Tree	N	C	Ayurveda, Folk and Sidha
95	*Lawsonia inermis L.*	*Mylanchi/* Henna plant,	shrub	N	C	Ayurveda, Siddha, Unani, Folk, Tibetan, Veterinary, Chinese
96	*Punica granatum L.*	*Mathalam/* Pomegranate	shrub	N	C	Ayurveda, Siddha, Unani, Homeopathy, Folk, Tibetan, Chinese
Malvaceae						
97	*Abelmoschus esculentus (L.) Moench.*	Venda/ Lady's Finger	shrub	N	C	Ayurveda, Siddha, unani, Folk
98	*Hibiscus hispidissimus Griff.*	*Panichakampuli*	shrub	N	W	Ayurveda, Folk
99	*Hibiscus rosa-sinensis L.*	*Chembarathi/* Shoeblack plant	shrub	N	C	Ayurveda, Folk, Unani and Sidha
100	*Hibiscus sabdariffa L.*	Mathipuli/ Rosella	shrub	N	C	Ayurveda, Folk, Sidha and Modern
101	*Hibiscus schizopetalus (Dyer) Hook.f.*	*Thookchemparathi/* Coral hibiscus	shrub	E	C	
102	*Urena lobata L.*	*Oorppan/* Congo Jute	shrub	N	W	Ayurveda, Siddha, Folk, Chinese
Melastomataceae						
103	*Pleroma urvilleanum (DC.) P.J.F.Guim. & Michelang.*	Princess Flower	shrub	E	C	
Meliaceae						
104	*Melia azedarach L.*	*Aaruveppu/* Indian Lilac	Tree	N	C	Ayurveda, Siddha, Unani, Folk, Tibetan, Chinese
105	*Swietenia macrophylla King*	Mahagoni/West Indian mahogani	Tree	E	C	Siddha, Folk
106	*Toona ciliata Roem.*	Chandanavembu/ Toon tree	Tree	N	C	Ayurveda, Siddha, Unani, Folk
Menispermaceae						
107	*Cyclea peltata (Lam.) Hook. f. & Thoms.*	Padakizhangu/ Pata root	Climber	N	W	Ayurveda, Folk and Sidha
Moraceae						
108	*Artocarpus heterophyllus Lam.*	Plavu/ Jack fruit tree	Tree	N	C	Ayurveda, Siddha, Folk, Chinese, Modern
109	*Artocarpus hirsutus*	Anjili/ Wild jack	Tree	N	W	Ayurveda, Siddha, Folk
110	*Artocarpus incisus (Thunb.) L.f.*	Kadaplavu/ Bread fruit tree	Tree	E	C	Ayurveda, Siddha, Folk
111	*Ficus auriculata Lour.*	*Atthimaram/* Elephant ear fig tree	Tree	N	C	Folk, and Sidha
112	*Ficus benjamina L.*	*Vellal/*Golden fig	Tree	N	C	

113	*Ficus elastica Roxb. ex Hornem.*	Assam rubber	Tree	N	C	
114	*Ficus exasperata Vahl*	Parakam/ Sandpaper tree	Tree	N	W	Ayurveda, Siddha, Folk
115	*Ficus heterophylla L.f.*	Vallitherakam	shrub	N	W	Ayurveda, Siddha, Folk
116	*Ficus hispida L. f.*	*Erumanakku*	Tree	N	W	Ayurveda, Siddha, Unani, Folk, Sowa Rigpa, Chinese
117	*Morus alba L.*	*Mulberry*/ White Mulberry	shrub	E	C	Ayurveda, Siddha, Unani, Folk, Chinese
118	*Moringa oleifera Lam.*	*Muringa*/ Horseradish/ Drumstick tree	Tree	N	C	Ayurveda, Siddha, Unani, Folk, Tibetan, Veterinary
Myristicaceae						
119	*Myristica fragrans Houtt.*	*Jathikka*/ Nutmeg	Tree	E	C	Ayurveda, Siddha, Unani, Homeopathy, Folk, Tibetan, Modern, Chinese
Myrtaceae						
120	*Eugenia uniflora L.*	Surinam cherry	shrub	E	C	
121	*Pimenta dioica (L.) Merr.*	*Sarvasuganthi*/All spices Plant	Tree	E	C	Homeopathy
122	*Psidium guajava L.*	*Peramaram*/ Common guava	Tree	E	C	
123	*Syzygium aqueum (Burm.f.) Alston*	*Chamba*/ Water apple	Tree	E	C	Folk, Chinese
124	*Syzygium cumini (L.) Skeels*	*Njaval*/ Black plum	Tree	N	C	Ayurveda, Siddha, Unani, Homeopathy, Folk, Tibetan, Chinese
125	*Syzygium jambos (L.) Alston*	*Panineerchamba*/ Rose apple	Tree	E	C	Ayurveda, Unani, Homeopathy, Folk, Chinese
126	*Syzygium myrtifolium Walp*	Cristina Plant	shrub	E	C	
127	*Syzygium samarangense (Blume) Merr. & L.M.Perry*	*Chamba*/ Java apple	Tree	N	C	Folk
Nyctaginaceae						
128	*Bougainvillea spectabilis Willd*	Kadalasupoovu/ Bougain villa	shrub	E	C	
Nymphaeaceae						
129	*Nymphaea pubescens Willd.*	*Ambal*/ Hairy water lily	Herb	N	C	Ayurveda, Siddha, Unani, Folk, Sowa Rigpa
Oleaceae						
130	*Nyctanthes arbor-tristis L.*	*Pavizhamalli*/ Night jasmine	shrub	N	C	Ayurveda, Siddha, Homeopathy, Folk, Veterinary
Oxalidaceae						
131	*Averrhoa bilimbi L.*	*IrumbanPuli*/ Tree sorrel, Bilimbi	Tree-Dicot	E	C	Ayurveda, Siddha, Folk
132	*Biophytum reinwardtii (Zucc.) Klotzsch.*	*Mukkuty*/ Biophytum	Herb	N	W	Ayurveda, Sidha, Folk

Passifloraceae						
133	*Passiflora edulis l.*	*Passion fruit*	Climber	E	C	Ayurveda, Folk
134	*Passiflora foetida L.*	Poodappazham/ Popwine	Climber	E	W	Ayurveda, Siddha, Folk, Chinese
Piperaceae						
135	*Piper nigram L.*	*Kurumulaku/* Black pepper	Climber	N	C	Ayurveda, Siddha, Unani, Homeopathy, Folk, Tibetan, Chinese
Portulacaceae						
136	*Portulaca grandiflora Hook.f.*	*Pathumani/* Table Rose	Herb	E	C	
Rhamnaceae						
137	*Ziziphus oenopolia(L.) Mill.*	*Thudali/* Jackal jujube	Climber	N	W	Ayurveda, Siddha, Folk
Rosaceae						
138	*Rosa multiflora Thunb.*	*Rose*	shrub	E	C	
Rubiaceae						
139	*Chassalia curviflora*	*Vellakurinji*	shrub	N	W	Ayurveda, Folk
140	*Chassalia curviflora (Wall. ex Kurz) Thw.*	*Vellakurinji*	shrub	N	W	
141	*Dentella repens (L.) J. R. & G. Forst.*	Cherumaneli	Herb	N	W	
142	*Ixora coccinea L.*	Kattuthetti/ West Indian Jasmine	shrub	N	W	Ayurveda, Folk and Sidha
143	*Ixora javanica (Blume) DC.*	*Ashokachetthi/* Jungle Geranium	shrub	N	C	
144	*Morinda pubescens J. E. Smith*	Manjanaathi/ Morinda tree	Tree	N	W	Ayurveda, Siddha, Folk
145	*Mussaenda frondosa l.*	*Vellilathaali/* Dhobi tree	shrub	N	W	Ayurveda, Siddha, Folk
146	*Oldenlandia corymbosa L.*	Onathumba	Herb	N	W	Ayurveda, Siddha, Chinese
147	*Richardia scabra L.*	False ipecac	Herb	N	W	

Green Guardians of LISSAH

148	*Spermacoce latifolia Aubl.*	Tharavu	Herb	N	W	
149	*Spermacoce ocymoides Burm.f.*	Tharakeera	Herb	N	W	
Rutaceae						
150	*Citrus limon (L.) Burm. f.*	Cherunarakam/ Lemon tree	Tree	N	C	Ayurveda, Unani, Folk, Homeopathy, Sowa Rigpa, Chinese, Modern
151	*Citrus maxima (Burm.f.) Merr.*	*Kambilinarakam/* Babloos / Pomilo	Tree	N	C	Ayurveda, Unani, Folk, Sowa Rigpa, Chinese
152	*Glycosmis pentaphylla (Retz.) DC.*	*Panal*	shrub	N	W	Ayurveda, Folk, Homeopathy and Sidha
153	*Murraya koenigii (L.) Spreng.*	*Kariveppila/* Curry leaf tree	shrub	N	C	Ayurveda, Siddha, Folk, Veterinary
Sapindaceae						
154	*Cardiospermum halicacabum L.,*	Uzhinja/ Heart's Pea	Climber	N	W	Ayurveda, Folk, Homeopathy, Unani and Sidha
155	*Litchi chinensis Sonner.*	*Lychee*	Tree	E	C	
156	*Nephelium lappaceum L.*	Rambutan	Tree	E	C	
157	*Schleichera oleosa (Lour.) Oken*	*Poovam/* Ceylon oak	Tree	N	W	Ayurveda, Folk, Sidha
Sapotaceae						
158	*Manilkara zapota*	Sappotta/ Chikku tree	Tree	E	C	Sidha, Folk
159	*Mimusops elengi L.*	*Elangi/* Bakul tree	Tree	N	C	Ayurveda, Siddha, Unani, Folk, Tibetan, Veterinary
Scrophulariaceae						
160	*Scoparia dulcis L.*	*Kallurikki/* Liquorice weed	Herb	N	W	Ayurveda, Folk, Sidha, Chinese
Simaroubaceae						
161	*Simarouba glauca DC.*	Lekshmi tharu	Tree	E	C	Folk
Solanaceae						
162	*Capsicum annuum L*	Green chilly/ Long chilly	Herb	E	C	Ayurveda, Siddha, Unani, Folk, Homeopathy, Chinese, Modern
163	*Capsicum frutescens L.*	Kantharimulak/ Birds chilly	Herb	E	C	Ayurveda, Unani, Sidha, Folk and Modern
164	*Datura stramonium L.*	Ummam- Thorn Apple	shrub	N	C	Ayurveda, Folk, Homeopathy, Unani and Sidha
165	*Lycopersicon esculentum Mill.,*	*Thakkali/* Tomato	Herb	E	C	Ayurveda, Siddha, Homeopathy
166	*Solanum melongena L*	*Vazhuthana*	Herb	N	C	Ayurveda, Siddha, Unani, Folk, Chinese
167	*Solanum torvum Sw.*	*Chunda/* Turkey berry	shrub	N	W	Ayurveda, Siddha, Folk, Chinese

Sterculiaceae						
168	*Theobroma cacao L.*	Cacao tree	Tree	E	C	Siddha, Folk, Modern
Talinaceae						
169	*Talinum portulacifolium (Forssk.) Asch. ex Schweinf.*	*Vassalacheera*	Herb	N	C	
Verbenaceae						
170	*Citharexylum spinosum L.*	*Parijatham*/ Fiddlewood	Tree	E	C	
171	*Clerodendrum infortunatum L.*	Peruvilam/ Tissue paper plant	shrub	N	W	Ayurveda, Folk, Homeopathy, Sidha
172	*Clerodendrum paniculatum L.*	*Krisnakereedam*/ Red Pagoda Tree	shrub	N	W	
173	*Clerodendrum thomsonae Balf.*	*Bleeding-heart*	Climber	E	C	
174	*Lantana camara L.*	Kongini/Lantana	shrub	E	W	Ayurveda and Folk
175	*Tectona grandis L.*	Thekk/Teak	Tree	N	C	Ayurveda, Siddha, Unani, Folk, Tibetan
Vitaceae						
176	*Ampelocissus indica (L.) Planch.*	Chembaravalli	Climber	N	W	
MONOCOTYLEDONS						
Amaryllydaceae						
177	*Hippeastrum × johnsonii (Gowen) Herb.*	Johnson's Amaryllis	Herb	E	C	
Araceae						
178	*Amorphophallus paeoniifolius (Dennst.) Nicolson,*	*Chena*/Elephant foot yam	Herb	N	C	Ayurveda, Folk
179	*Anthurium andraeanum Linden ex André*	Anturium/ Painter's-palette	Herb	E	C	
180	*Caladium bicolor (Ait. ex Dryand.) Vent.*	Varnachembu/ Caladium	Herb	E	W	
181	*Colocasia esculenta (L.) Schott*	Chembu/ Wild Taro	Herb	N	W	Ayurveda, Folk, Unani and Sidha
182	*Dieffenbachia seguine (Jacq.) Schott,*	Dieffendachia	Herb	E	C	
183	*Epipremnum aureum (Linden & André) G.S.Bunting*	Money Plant	Climber	E	C	
184	*Spathiphyllum wallisii Regel*	*Peace lily*	Herb	E	C	
Arecaceae						
185	*Areca catechu L.*	*Kavug*/ Areca palm	Tree	N	C	Ayurveda, Siddha, Unani, Folk, Homeopathy, Sowa Rigpa, Chinese, Modern
186	*Caryota urens L.*	Choondapana/ Toddy palm	Tree	N	W	Ayurveda, Folk and Sidha
187	*Cocos nucifera L.*	Thengu/ Coconut tree	Tree	N	C	Ayurveda, Folk, Tibetian, Unani and Sidha

188	*Cyrtostachys renda Blume*	Red palm	Tree	E	C	
189	*Dypsis lutescens (Wendl.) Beentje & Dransf.*	Yellow Palm	shrub	E	C	
190	*Roystonea regia (Kunth) O.F. Cook*	Cuban Royal Palm	Tree	E	C	
191	*Wodyetia bifurcata A.K.Irvine*	*Foxtail palms* Foxtail palms	Tree	E	C	
		Asparagaceae				
192	*Asparagus racemosus Willd.*	*Shatavari*/Wild asparagus	Climber	N	C	Ayurveda, Folk, Tibetian, Unani and Sidha
193	*Cordyline fruticosa (L.) A.Chev.*	Ti Plant	shrub	E	C	
194	*Dracaena trifasciata (Prain) Mabb*	Snake plant	Herb	E	C	
		Commelinaceae				
195	*Tradescantia spathacea Sw.*	Rheo/ Moses-in-the-cradle	Herb	E	C	
		Dioscoreaceae				
196	*Dioscorea alata L.*	*Kachil/* Greater Yam	Climber	N	W	Ayurveda, Siddha, Folk, Chinese
		Heliconiaceae				
197	*Heliconia psittacorum L.f.*	Heliconia	Herb	E	C	
		Liliaceae				
198	*Aloe vera (L.) Burm. f.*	Kattarvazha/Aloe	Herb	E	C	Ayurveda and Sidha
		Musaceae				
199	*Ensete superbum (Roxb.) Cheesman.*	*Kalluvazha/* Wild plantain	shrub	N	C	Ayurveda, Folk
200	*Musa x paradisiaca L.*	Vazha/ Banana	shrub	N	C	Ayurveda, Siddha, Unani, Homeopathy, Folk, Tibetan
		Poaceae				
201	*Axonopus compressus (Sw.) P. Beauv.*	*Erumapullu/* Buffalo Grass	Herb	N	W	
202	*Bambusa balcooa Roxb.*	*Mula*/Female Bamboo	Tree	E	C	
203	*Bambusa tuldoides Munro*	Buddha's belly bamboo	Tree	E	C	
204	*Bambusa vulgaris Schrad.*	*Seemamula/* Yellow bamboo	Tree	E	C	
205	*Brachiaria ramosa (L.) Stapf in Prain*	Chamapothaval	Herb	N	W	
206	*Centotheca lappacea (L.) Desv.*		Herb	N	W	
207	*Chloris barbata Sw.*	Mayil pullu	Herb	N	W	Sidha & Folk
208	*Chrysopogon aciculatus (Retz.) Trin.,*	Snehapullu/ Love grass	Herb	N	W	Ayurveda, Siddha, Folk, Chinese

209	*Cynodon dactylon (L.) Pers*	Karuka/ Scutch grass	Herb	N	W	Ayurveda, Folk, Homeopathy, Tibetian, Unani and Sidha
210	*Dactyloctenium aegyptium (L.) P. Beauv*	*Kavarapullu*/Egyptian crowfoot grass	Herb	E	W	Ayurveda, Folk, and Sidha
211	*Digitaria ciliaris (Retz.) Koeler*	Henry's crabgrass	Herb	N	W	
212	*Megathyrsus maximus (Jacq.) B.K.Simon & S.W.L.Jacobs*	Ginipullu/ Guinea grass	Herb	E	C	
213	*Oplismenus compositus (L.) P. Beauv.*		Herb	N	W	
214	*Panicum notatum Retz.*		Herb	N	W	
215	*Pennisetum polystachyon (L.) Schult.*	*NambissanPullu/* Pennisetum	Herb	N	W	
216	*Pseudanthistiria umbellata (Hack.) Hook. f.*		Herb	N	W	
217	*Saccharum officinarum L.*	*Karimbu/* Sugar cane	Shrub	N	C	Ayurveda, Siddha, Unani, Folk, Tibetan
218	*Thyrsostachys oliveri Gamble*	*Lathimula*	Tree	E	C	
219	Zoysia japonica	*Korean lawngrass*	Herb	E	C	
Zingiberaceae						
220	*Curcuma longa L.*	*Manjal/* Turmeric	Herb	N	C	Ayurveda, Folk, Homeopathy, Tibetian, Unani and Sidha
221	*Zingiber officinale Rosc*	*Inchi/* Ginger	Herb	N	C	Ayurveda, Siddha, Unani, Folk, Homeopathy, Chinese, Modern
GYMNOSPERMS						
Araucariacreae						
222	*Araucaria columnaris* (G.Forst.) Hook	*Xmas tree*	Tree	E	C	
Cupressaceae						
223	*Hesperocyparis macrocarpa (Hartw.) Bartel*	Monterey cypress	Tree	E	C	
Cycadaceae						
224	*Cycas circinalis L.*	Eenth/ False Sago	Tree	N	C	Ayurveda, Folk, and Sidha

Tree Diversity and Carbon Sequestration Potential of the Campus

The major findings of tree diversity study in the campus and carbon sequestration potential of the campus are:

- There are 836 trees present in the campus of which 412 are Dicot trees, 417 monocot trees and 7 Gymnosperm trees
- The trees exhibit comparatively high species diversity, coming under 78 species of which 65 are dicotyledons, 10 Monocotyledons and 3 Gymnosperms.
- The highest number of trees present are of Coconut Palm (213 nos.) followed by Areca nut Palm (126 nos.), both Monocots. This is followed by Mahogany (59 nos.) and Teak (57 nos.). There are 15 species represented by more than 10 plants (10-28). 26 species are represented by only 1 plant each and 17 with 2 plants.
- Most of the tree species are cultivated (67 species) are cultivated for various purposes and 11 are growing wild as escapes from nearby forest areas.
- Out of the 78 tree species present 40 (51%) are exotic plants 38 (4%) are native to India. However, regarding the number of trees present 69 % are native trees and only 31% native trees. This because of the high density of Coconut and Areca nut plams.
- The girth of the trees ranges from 15 cm to 189 cm. Since the campus is comparatively new the largest tree is having only 189 cm girth and is a mango tree.
- The rubber monocropping in around 1 Ha area is now removed and the area is now only with some bushes grown as escapes
- The campus is maintaining lawns with carpet grasses in around 0.35 ha of land in the campus and is very much helping for water percolation in addition to the picturesque landscape.
- Organic vegetable cultivation is undergoing in around 0.50 ha of land in the campus by using organic manure developed in own animal farm.
- The total carbon sequestrated by all trees in the campus so far is **295.20 ton**
- The **annual carbon sequestration potential** of the Campus is estimated at **14.90 ton**

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

Table 2.1.2 Tree Diversity of LISSAH Campus

Sl. No.	Scientific Name	Local/English Name	No. of Plants	Girth Range at Breast Height (cm)*	Total CO_2 Eq. sequestrated (Ton)
DICOT TREES					
1	*Alstonia scholaris (L.) R. Br*	Ezhilampla-Devil tree	1	32	0.10
2	*Anacardium occidentale L.*	Parangimavu/ Kasumavu-Cashew Tree	1	27	0.06
3	*Annona muricata L.*	*Mullatha*-Soursop	1	29	0.08
4	*Annona squamosa L.*	*Atha*-Custard apple	7	16-30	0.33
5	*Artocarpus heterophyllus Lam.*	Plavu- Jack fruit tree	14	27-157	14.68
6	*Artocarpus hirsutus*	Anjili-Wild jack	2	32-64	0.54

Sl. No.	Scientific Name	Local/English Name	No. of Plants	Girth Range at Breast Height (cm)*	Total CO_2 Eq. sequestrated (Ton)
7	*Artocarpus incisus (Thunb.) L.f.*	Kadaplavu-Bread fruit tree	11	27-105	2.98
8	*Averrhoa bilimbi L.*	*IrumbanPuli*-Tree sorrel, Bilimbi	2	36-68	0.66
9	*Bauhinia variegata L.*	*Chuvanna Mandaram*-Mountain ebony	10	35-98	1.50
10	*Carica papaya L.*	Pappaya-Papaya	27	16-35	1.26
11	*Cassia fistula L.*	Kanikonna-Golden shower tree	19	17-82	1.56
12	*Casuarina equisetifolia L.,*	*Kattadi*-Beach she-oak	2	22-28	0.10
13	*Cinnamomum verum Presl*	*Karuva*-Cinnamon tree	13	37-138	12.01
14	*Citharexylum spinosum L.*	*Parijatham*-Fiddlewood	1	24	0.05
15	*Citrus limon (L.) Burm. f.*	Cherunarakam-Lemon tree	2	16-24	0.04
16	*Citrus maxima (Burm.f.) Merr.*	*Kambilinarakam*-Babloos / Pomilo	1	29	0.08
17	*Couroupita guianensis Aublet*	*Nagalingamaram*-Cannon ball tree	1	70	0.70
18	*Dalbergia latifolia Roxb*	Eetti-Rose wood	2	34-48	0.36
19	*Erythrina stricta Roxb*	Murikk-Indian Coral tree	1	39-45	0.23
20	*Ficus auriculata Lour.*	*Atthimaram*-Elephant ear fig tree	3	41-121	2.11
21	*Ficus benjamina L.*	*Vellal*-Golden fig	2	15-19	0.04
22	*Ficus exasperata Vahl*	Parakam-Sandpaper tree	1	17	0.02
23	*Ficus hispida L. f.*	*Erumanakku*	1	18	0.02
24	*Flacourtia jangomas*	Loulokia -Puneala plum	1	22	0.04
25	*Garcinia mangostana L.*	*Mangosteen*	2	22-34	0.14
26	*Gliricidia sepium (Jacq.) Kunth ex Walp*	*Seema konna* – Spotted Gliricidia	1	15	0.01
27	*Lagerstroemia speciosa (L.) Pers.*	Manimaruth-Pride of India	4	19-45	0.28
28	*Libidibia coriaria (Jacq.) Schltdl.*	*Dividivi plant*-American sumac	5	17-46	0.38
29	*Litchi chinensis Sonner.*	*Lychee*	1	23	0.04
30	*Macaranga peltata (Roxb.) Muell.-Arg.*	Vatta	1	28	0.07
31	*Mangifera indica L.*	*Mavu*-Mango Tree	28	15-189	9.27
32	*Manilkara zapota*	Sappotta-Chikku tree	5	23-78	1.15
33	*Melia azedarach L.*	*Aaruveppu*-Indian Lilac	17	15-152	1.75
34	*Mimusops elengi l.*	*Elangi*-Bakul tree	11	29-78	3.13
35	*Monoon longifolium (Sonn.) B.Xue & R.M.K.Saunders*	*Arana maram*-Indian mast tree	4	24-46	0.64
36	*Morinda pubescens J. E. Smith*	Manjanaathi-Morinda tree	2	15-17	0.03
37	*Moringa oleifera Lam.*	*Muringa*-Horse radish/ Drumstick tree	6	27-54	0.58
38	*Muntingia calabura L,*	*Pancharappazham*-Birds cherry	3	52-69	1.31

Sl. No.	Scientific Name	Local/English Name	No. of Plants	Girth Range at Breast Height (cm)*	Total CO_2 Eq. sequestrated (Ton)
39	*Myristica fragrans Houtt.*	*Jathikka*-Nutmeg	4	19-35	0.30
40	*Nephelium lappaceum L.*	Rambutan	2	24-28	0.11
41	*Peltophorum pterocarpum (DC.) Backer ex Heyne*	*Charakonna* Yellow Flame Tree	1	45	0.23
42	*Persea americana Mill.*	*Vennappazham*- Avocado Pear	4	37-74	1.08
43	*Phyllanthus acidus (L.) Skeels*	*Arinelli* – Star Gooseberry	1	16	0.02
44	*Phyllanthus emblica L.*	*Nelli*-Indian gooseberry	10	16-77	0.97
45	*Pimenta dioica (L.) Merr.*	*Sarvasuganthi*- All spices Plant	1	17	0.02
46	*Plumeria rubra L.*	*Ezhachampakam*- Frangipani	2	15-19	0.04
47	*Pongamia pinnata (L.) Pierre*	*Pongam- Ungu*- Indian beech tree	4	18-58	0.73
48	*Psidium guajava L.*	*Peramaram*- Common guava	24	17-48	0.90
49	*Racosperma auriculiforme*	Acacia	4	15-22	0.09
50	*Saraca asoca (Roxb.) de Wilde*	*Ashokam*- Ashoka tree	1	28	0.07
51	*Schleichera oleosa (Lour.) Oken*	*Poovam*- Ceylon oak	1	27	0.06
52	*Sesbania grandiflora (L.) Poir.*	Agasthi cheera	1	17	0.02
53	*Simarouba glauca DC.*	Lekshmi tharu	2	19-39	0.15
54	*Swietenia macrophylla King*	Mahagoni- West Indian mahogani	59	29-100	34.37
55	*Syzygium aqueum (Burm.f.) Alston*	*Chamba*- Water apple	2	18-28	0.08
56	*Syzygium cumini (L.) Skeels*	*Njaval*-Black plum	1	42	0.10
57	*Syzygium jambos (L.) Alston*	*Panineerchamba*- Rose apple	1	23	0.04
58	*Syzygium samarangense (Blume) Merr. & L.M.Perry*	*Chamba*- Java apple	1	22	0.04
59	*Tectona grandis L.*	Thekk-Teak tree	57	17-132	33.20
60	*Terminalia arjuna (Roxb. ex DC.) Wight & Arn.*	*Neermarathu/pulimatti*- Arjun tree	1	48	0.27
61	*Terminalia bellirica (Gaertn.) Roxb.*	*Thanni*-Terminaliabellirica	1	48	0.27
62	*Terminalia catappa L.*	*Badam*-Indian-almond	2	32-44	0.30
63	*Terminalia paniculata Roth*	Maruth- Flowering murdah	1	32	0.10
64	*Theobroma cacao L.*	*Coco*-Cacao tree	7	19-57	1.12
65	*Toona ciliata Roem.*	Chandanavembu- Toon tree	1	15-189	0.10
Total			**412**		**133.10**

MONOCOT TREES					
66	*Bambusa bambos (L.) Voss*	*Mula* Thorny bamboo	15	15-24	0.55
67	*Bambusa tuldoides Munro*	Buddha's belly bamboo	24	15-17	0.44
68	*Bambusa vulgaris Schrad.*	*Seemamula*— Yellow bamboo	12	17-32	0.74
69	*Thyrsostachys oliveri Gamble*	*Lathi mula*	8	15-16	0.13
70	*Areca catechu L.*	*Kavug*-Areca palm	126	29-43	15.93
71	*Caryota urens L.*	Choondapana-Toddy palm	2	36-90	1.75
72	*Cocos nucifera L.*	Thengu-Coconut tree	213	50-90	127.14
73	*Cyrtostachys renda Blume*	Red palm	3	15-20	0.06
74	*Roystonea regia (Kunth) O.F. Cook*	Cuban Royal Palm	12	80-125	14.25
75	*Wodyetia bifurcata A.K.Irvine*	*Foxtail palm*	2	35-41	0.30
Total			**417**	**15-125**	**161.29**
GYMNOSPERMS					
76	*Araucaria columnaris (G.Forst.) Hook*	Xmas tree	3	29-54	0.69
77	*Cycas circinalis L.*	Eenth-False Sago	2	20-26	0.08
78	*Hesperocyparis macrocarpa (Hartw.) Bartel*	Monterey cypress	2	21-27	0.09
Total			**7**	**20-54**	**0.86**
Grand Total			**836**	**15-189**	**295.20**

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 survey and analysis are yet to be done.

Especially for students of social sciences, learning floral and faunal diversity require identification of tree and plant species, and of the animal kingdom right on the ground by noting leaves, flowers, nature of trunk and canopy, living habits, etc. Look, touch, and feel under expert guidance gives deeper knowledge about the value of lawns, hedges, shade trees and trees of economic importance, as well as of the insects, birds and small animals.

Maintenance of lawns, and open green spaces too have enormous ecological benefits, apart from their soothing look for the beholders. Students at LISSAH are trained for the proper upkeep of hedges and lawns. This is a playground as well as learning ground.

Suggestions / Recommendations

1. It is essential to prepare the biodiversity register of the campus in a scientific way with photographs of all plants and visiting/nurturing animals.
2. The trees in the campus shall be geotagged and monitored annually for girth increment so that we will get a real picture of annual carbon sequestration potential.
3. The campus has now the opportunity to increase its biodiversity potential since the rubber monocropping area is now available for establishing vegetation. In order to get more benefits out of biodiversity conservation, there is a need for establishing more indigenous trees. Planting diverse species will help in more water conservation and increasing the faunal diversity and providing more ecosystem services. Some indigenous plant species growing in Kozhikode and Wayanad districts are suggested for the LISSAH campus as given in Table 2.1.3.
4. Some tropical fruit trees suitable for the area also may be planted based on a clear plan to make the plantation economically attractive.
5. As there are enough spaces available in the campus for establishing specialized gardens, a suitable plan be drawn to establish 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 the LISSAH campus noted for farm/educational tourism. It will also attract more students to the campus.
6. A "special campus greening drive" with the fast-growing afforestation technique like the one evolved by Prof. Akira Miyawaki of Japan also may be tried to keep the lead in the institute's current climate change mitigation initiative.

Table 2.1.3: 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	Medicina;	Vulnerable endemic to SWG
3	*Alangium salviifolium*	Ankolam	Alangiaceae	Medicinal/ Edible fruit	
4	*Antidesma ghaesembilla*	Kattupulinchi	Euphorbiaceae	Medicinal	
5	*Aralia malabarica*		Araliaceae		Vulnerable endemic to SWG
6	*Ardisia solanacea*	Kakkanjara	Myrsinaceae	Medicinal	Bird's Attraction
7	*Artocarpus gomezianus ssp. zeylanicus*	Kattukadaplavu Pulichakka	Moraceae	Medicinal	
8	*Atuna travancorica*	Kallan kaimaram	Chrysobalan Aceae		Endangered & endemic to SWG
9	*Averrhoa carambola*	Chathurapuli	Oxalidaceae	Medicinal- Edible fruit	
10	*Baccaurea courtallensis*	Moottippazham	Euphorbi Aceae	Edible fruit	

Sl. No.	Botanical Name	Malayalam name	Family	Use	Conservation Status
11	*Butea monosperma*	Chamatha, Plash, Brahmavriksham	Fabaceae	Medicinal	
12	*Chionanthus mala-elengi ssp.linocieroides*		Oleaceae	Medicinal	Endangered & Endemic to SWG
13	*Cinnamomum malabatrum*	Illavangam, Vayana	Lauraceae	Medicinal	Endemic to SWG
14	Cynometra beddomei	Cherukoori	Fabaceae		Endangered & Endemic to SWG
15	Cynometra travancorica	Koori	Fabaceae		Endangered & Endemic to SWG
16	Diospyros candolleana	Karimaram-Ebony	Ebenaceae	Medicinal	Endemic to SWG
17	*Elaeocarpus variabilis*	Kara	Elaeocarpaceae	Medicinal-Edible fruit	Endemic to WG
18	Euonymus angulatus		Celastraceae		Vulnerable Endemic to SWG
19	*Ficus beddomei*	Thavittaal	Moraceae	Bird's Attraction	Endemic to WG
20	*Garcinia gummi-gutta*	Kudampuli	Clusiaceae	Medicinal Edible fruit	
21	*Garcinia indica*	Punampuli	Clusiaceae	Medicinal Edible fruit	Endemic to WG
22	*Gordonia obtusa*	Adangi, Kattukarana	Theaceae	Medicinal	Endemic to WG
23	*Grewia tiliifolia*	Chadachi, Dhanauna-vriksham, Unnam	Tiliaceae	Medicinal-Edible fruit	
24	*Hopea parviflora*	Kambakam-Malabar Iron Wood	Diptero Carpaceae	Medicinal - Wood	Endemic to SWG
25	*Humboldtia brunonis var. raktapushpa*	Chuvanna Katashokam	Fabaceae	Medicinal	Endemic to Kerala
26	*Hydnocarpus pentandra*	Marotti	Flacourtiaceae	Medicinal	Endemic to WG
27	*Magnolia champaca*	Swarna chambakam	Magnoliaceae	Medicinal - Ornamental	
28	Memecylon flavescens	Kayampoo	Melastomataceae		Endangered & endemic to SWG
29	*Memecylon sisparense*	Kayampoo	Melastomataceae		Critically Endangered & endemic to SWG
30	*Mesua thwaitesii*	Nangu	Cusiaceae	Medicinal	
31	*Myristica malabarica*	Malabar nutmeg	Myristicaceae	Medicinal	Vulnerable, endemic to WG
32	*Neolamarckia cadamba*	Kadamb	Rutaceae	Medicinal	
33	*Olea dioica*	Karivetti	Oleaceae	Medicinal	Vulnerable, endemic to India
34	Prioria pinnata	Churali, Ennappayin, Kiyavu	Fabaceae	Medicinal	Endangered & endemic to SWG

Sl. No.	Botanical Name	Malayalam name	Family	Use	Conservation Status
35	*Pterospermum rubiginosum*	Chittilaplavu, Ellooti, Malamthodali	Sterculiaceae	Medicinal	Endemic to SWG
36	*Spondias pinnata*	Ambazham	Anacardiaceae	Edible fruit	
37	*Strychnos nux-vomica*	Kanjiram	Loganiaceae	Medicinal	
38	Symplocos macrophylla	Malankuruvi	Symplocaceae		Endangered and endemic to SWG
39	*Syzygium travancoricum*	Vathamkolli maram	Myrtaceae	Edible fruit	Critically endangered and endemic to SWG
40	Tarenna nilagirica		Rutaceae		Vulnerable endemic to SWG
41	*Vaccinium leschenaultii*	Kalavu	Vacciniaceae	Medicinal-Edible fruit	Endemic to SWG
42	*Ziziphus mauritiana*	Lanthapazham	Rhamnaceae	Medicinal-Edible fruit	

Lush vegetation in LISSAH campus

A Protected Pond in LISSAH

2.2.1. Energy Audit

'Energy Audit' is a very useful activity for an institution. Owners find it useful as it helps them save money on energy cost. It also helps in reducing the carbon footprints and in raising its green status. Students can practice energy management even at home through simple audit exercises learnt from the Institute. Energy saving is easy to achieve. The results in terms of performance, and the profits are immediately visible. But, people seldom pay attention to the simple approaches that can save volumes of energy, even without spending a rupee on it.

LISSAH as an Institute is currently paying an average cost of Rs. 13 on every unit (kWh) of electricity it uses. It can plan to bring down this cost through simple analysis of energy data. Getting the same or more of work done with less energy through carefully chosen energy saving measures, is called 'energy management'. To minimise the losses and wastes within the campus, staff and students should know where and when, and how and how much energy is used in getting the needed energy services. Targeting a better energy efficiency scenario – i.e., either reduce energy input for the same work, or get more from every unit of energy used – is the objective of energy audit. The major sources of carbon emissions in an educational institution are the use of electricity and other forms of energy, transportation, and wastes linked to food preparation and consumption, as well as other simple actions we do carelessly.

No	Equipment	Watt	Qty	hour	No	Equipment	Watt	Qty	Hour
1	Ceiling Fan	80	284	5	21	Air Conditioner	1000	5	4
2	Wall Fan	100	20	2	22	Fluorescent Tube	40	92	5
3	Exhaust Fan	75	2	8	23	Fluorescent Tube	36	116	5
4	Table Fan	70	1	4	24	CFL	15	12	6
5	CCTV Camera	5	61	24	25	CFL	18-20	6	6
6	CCTV Monitor	80	1	24	26	CFL	60	3	6
7	Desktop Computer	250	40	4	27	LED TV	150	2	1
8	Computer Printer	600	3	2	28	Biometric scan	12	1	10
9	Printer + Scanner	1500	4	2	29	Electric Bell	30	2	--
10	Scanner	25	2	0.5	30	Amplifier + Mixer	7000	1	1
11	LED lamp	90	1	8	31	LCD Projector	560	3	0.5
12	LED lamp	60	1	8	32	Water Cooler	750	4	24
13	LED lamp	36	1	8	33	Water Purifier	25	1	24
14	LED Street light	28	7	10	34	Induction Cooker	2000	1	1
15	LED lamp/Tube	20	13	4	35	Coffee maker	750	2	0.5
16	LED lamp	18	57	4	36	Napkin Destroyer	2500	1	0.5
17	LED lamp	15	12	4	37	Inverter	229	1	6
18	LED lamp	9-10	75	6	38	Inverter	1000	1	6
19	LED lamp	3-5	9	12	39	Inverter UPS	3000	5	8
20	Incandescent lamp	60	3	0.5	40	Mixer Grinder	750	1	0.5
						Connected load	95 kW		
						Energy Use (est.)			

Table 2.2.1.1: Connected Load to the Electricity Supply to LISSAH

As a part of the current year's green audit, the data pertaining to electricity, transportation, water, wastes are closely monitored to see whether the LISSAH students are 'conservation conscious' or not.

In a campus like LISSAH in Kerala, it is customary to have energy use from different sources – such as electricity, petroleum gas, diesel, petrol, firewood, etc., with a view to minimising the total expenses. For getting 'energy services' that are unavoidable for the staff and students to live inside the campus, as well as for the day scholars attending the programmes offered therein, a lot of energy is to be used, but a part of that energy will go waste. Most of the time, the major component of carbon footprint which indicates its ecological performance will be either from the energy related activities or from transportation.

An 'Investment Grade' energy audit, if conducted for the LISSAH campus, can present a picture of actions required to control energy costs' and the approach needed for ensuring 'security of power supply'. The campus population of LISSAH is as follows: Students (boys and girls): 693; Teaching Staff: 41; Non-teaching staff: 15; Total: 749. Staff and students staying in the campus: 275 (Of this 200 are girl students).

Month 2019-20	College Academic kWh	Bill Rs.	Mess kWh	Bill Rs.	UG Hostel kWh	Bill Rs.	PG Hostel kWh	Bill Rs.	Total kWh	Total Elec. cost Rs.
'19 April	3,707	42,561							3,707	42,561
May	865	15,135	425	3,671	867	9,093	341	3,924	2,498	31,823
Jun	1,140	13,111							1,140	13,111
July	1,380	18,008	618	2,045	156	2,726	110	3,205	2,264	25,984
Aug	1,650	26,621							1,650	26,621
Sep	1,566	18,008	358	4,121	940	10,806	255	2,928	3,119	35,863
Oct	2,315	26,621							2,315	26,621
Nov	1,350	21,901	322	3,046	1,139	12,992	243	2,793	3,054	40,732
Dec	1,958	29,921							1,958	29,921
'20 Jan	1,386	24,198	589	5,441	1,335	14,933	154	2,697	3,464	47,269
Feb	1,690	27,165							1,690	27,165
Mar	2,190	32,380	348	3,126	1,151	13,216	265	2,124	3,954	50,846
Total kWh	**21,197**		**2,660**		**5,588**		**1,368**		**30,813**	
Total EE Cost	**Rs:**	**2,95,630**		**21,450**		**63,766**		**17,671**		**3,98,517**

Note: * As Covid time consumption is far less compared to a normal working year, consumption figures for 2019-20 is used for Carbon footprint calculation.

Annual Total Consumption in kWh = 30,813
Monthly Average Consumption in kWh = 2,568
Year Total Energy Cost = Rs. 3,98,517
Average per unit cost = Rs. 13.00

Table 2.2.1.2: Monthly Electricity Consumption and Cost incurred

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LISSAH's average monthly electricity consumption comes to 2,568 kWh during the year. The annual energy consumption that accounts for GHG emission due to electricity use in the campus is the total for the year 30,813 kWh.

The per capita annual electricity consumption is 30,813/749 = 41 kWh (units), which is not high. There are very economic ways of reducing energy consumption further and the carbon footprint due to electricity consumption, as well as of achieving an overall higher efficiency.

The Institute has a standby diesel generator of capacity 25 kVA. It require 6 litre of diesel for one hour running. For the year On the average, daily power supply interruption is for 15 minutes and it was run for a total of 125 hours.

Observations and Suggestions

1. As it is not possible for any education institution to keep a uniform energy demand level either on daily or monthly basis, the monthly variations though not high, may be examined against additional activities, or special events. The College does not monitor the energy use pattern in different activity zones or for exclusive uses like energy used for water pumping, water purification, hostel, laundry, etc. Half yearly evaluation of such sub-sectors will help in upgrading the strategy of energy conservation.
2. The extent of power failures and how often (reliability) - are to be recorded regularly in a separate register (A sample format is provided). Though the total running duration of the generator are presented for audit, for the future, a more systematic documentation is needed.

Standby Power Generator Log

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

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

(Format) Record of Standby Power & Power supply Interruptions

3. LISSAH may consider the application of Life Cycle Cost approach and prepare plans for reducing investment costs and operating costs to an appropriate level. A workshop in which management and teaching staff are participating may be organized, with experts in energy management briefing them on options.
4. It is also suggested that a detailed (investment grade) energy audit for the campus be conducted at the earliest with sector-wise electrical consumption studied, to evaluate the system arrangements and consider economic opportunities through efficiency enhancement, and at the same time to bring the carbon footprint to the minimum.

2.2.1. Energy Efficiency Improvement

Improving energy efficiency is an important task before any manager in these days of climate change manifestations. The most attractive opportunity in the path of greening through energy management is the avoidance of incandescent bulbs and replacement of ordinary fluorescent tubes. The institution has for its buildings started installing energy efficient equipment when replacements are warranted.

As of now, LISSAH has in their electrical wired system, the following devices which are far from the most efficient kind of products that are currently in the market (Listed in Table 2.2.1.1):

Ceiling Fans 1200 mm (48") sweep, 80 W = 284
Fluorescent Tube lamps 1200 mm (4') of 40 W power = 92
Fluorescent Tube lamps 1200 mm (4') of 36 W power = 116

Major reduction in GHG gases emitted and the Carbon Footprint, can arise from electrical energy savings in the use of fans. There are 284 conventional single phase a/c fans in the college. With AC fans of 1200 mm sweep, a replacement with brushless d. c. (BLDC) fans [26 W], the power saving is roughly 50 to 55 watts. Assuming an average 6 hrs per day of use, and 250 days in a year, the energy cost savings (average net cost of Rs. 13 per kWh) will be (50 W x 6 h x 250 d) divided by 1000 and multiplied by Rs. 13. That is Rs. 975 (say Rs. 1000) in a year from one fan alone. Such a fan costs Rs. 2500-3000 if purchased in bulk; roughly 500-1000 rupee more than conventional ac fans. For initial installations, BLDC is therefore a better choice, because the extra investment is completely repaid in one year. This fan has certainly a life span of 20 – 25 years. For the next 24 years, savings in 'current charge' due to one BLDC fan will be nearly Rs. 24,000. In addition, these fans have remote control facilities to smoothly vary the speed and save extra. For replacement as well, full investment of even Rs. 3000 will be repaid in 3 years.

According to 'Life Cycle Cost' approach, the cost comparison is like this:
For homes: *Initial cost + Op cost (electricity) = Total LCC*
(60 W fan, 8 hr/day, 20 year use, Rs 5/kWh): 60Wx8hx365x5x20/1000
Ordinary AC fan Life cycle cost = 2,000 + 17,520 = Rs. 19,520
BLDC fan Life cycle cost. = 3,000 + 7,592 = Rs. 10,592
(26 W, 8 hr/day, 20 year, Rs 5/kWh)

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

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

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

2.2.2: Renewable Energy Use Audit

The excessive warming of the globe was no doubt on account of the trapped greenhouse gases in our atmosphere. The major portion of these gases, to the extent of 70% plus, is due to CO_2 owing to the increased use of fossil fuels for energy generation, for motive power, lighting, and for industrial and commercial uses. Therefore, global warming can only be halted through reduced use of energy from carbonaceous fossil fuels such as coal, oil, and natural gas. Right in 2019, more than 70% of electricity that Kerala state was using, came ultimately from fossil fuel power stations from States outside of Kerala. Yet, it is possible even to improve our welfare using less energy, at the same time sticking on to increased energy efficiency, and depending on energy through non-fossil, or renewable sources such as wind, sunshine, water, biomass, etc.

At LISSAH, only a biogas plant with organic kitchen wastes as feedstock is the only renewable energy system in use. The College Management may plan to introduce solar photovoltaic (SPV) power to offset the carbon footprints it is currently making, and to bring down the electricity charges, which is ~ Rs. 4 lakh during the audit year. If properly visualised, through this effort, it is possible also to raise the energy security level in the campus. It can also eliminate the higher level of CO_2 emissions from the fossil fuel based standby generator.

Other Fuels Used: 1. LPG

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

2. Wood

Wood used/year in different places					
Canteen for cooking	kg	Hostel For cooking	kg	(specify) Training Centre	Kg
-		60 kg/day			

3. Diesel

used/year in different places					
Standby Generator Place/Purpose	Litre	(Hospital; Lab) Place/Purpose	Litre	(specify) Place/Purpose	Litre
25 kVA	750		litre	--	

4. Biogas

Biogas used/day in different places					
Canteen for Cooking	Cum	Hostel For Cooking	Cum	Heating Water Place/Purpose	Hours/ Cum
--		Per day 8	m^3	--	

Table 2.2.2.3: Energy sourced from sources other than electricity

6 kW Solar PV panels at LISSAH

Observations & Suggestions

1. During the audit year, LISSAH was installing a 6 kW Solar installation. COVID made the related work to go slow and it could be commissioned in the next AY only. Institute may expand the same and get the entire CF compensated. Solar thermal units for water heating and boiling is also possible, band it is extremely cost effective

Elevated structure to be shade free

2. Optimize energy use in the campus: The College may link up with any one of the Engineering Colleges in the district, and conduct an energy optimization study by which every energy consuming area is analyzed separately to find out to what level energy saving technologies are to be deployed to bring the energy use to the minimum. If an economic analysis is also conducted, the savings possible in carbon emissions and also the economic benefits can be clearly assessed. Based on the findings, LISSAH can choose to invest further in energy efficiency and reap savings every year.

3. As the Institute is involved in farming in the campus, the renewable energy adaptations can be effectively used in the campus to bring down costs, pest control, micro irrigation, etc.

4. Ventilation in the classrooms and auditorium can also be improved by going green with Renewables.

2.3. Water Audit

LISSAH campus in Kozhikode district is 'Green' by all standards and is well maintained. Average annual rainfall in Kerala is 3000 mm. Kozhikode gets an average annual precipitation of 3266 mm. Adequate water supply for drinking, personal use, gardening, agriculture, and animal husbandry is however, not guaranteed in many of the districts of Kerala, especially in the districts north of Kozhikode. But, many people including students in other parts of the State are unable to have a mental picture of the prospect of water shortage, even after several calamities have struck the State in the recent past. So, the focus of water audit in the campus is to find out whether adequate water is ensured for all activities, and also to make sure that excessive pollution of water, or wastage of this precious commodity is not taking place.

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

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

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

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

NAAC's aim is to ensure that such situations are avoided in the college premises at all times of the year.

In 'water stressed' regions, 'extra care' is required for discouraging the methods of wasteful water use by the campus residents as well as by the public. As of 2019, according to World Resources Institute (WRI), the extremely high water-stress experiencing countries are - in order of their ranking - Qatar, Israel, Lebanon, Iran, Jordan, Libya, Kuwait, Saudi Arabia, Eritrea, UAE, San Marino, Bahrain, India (13th), Pakistan, Turkmenistan, Oman, and Botswana. It is in these 17 nations that nearly 1.7 billion (22%) of the world's population reside, with the lion's share (1.37 billion or18%) living in India. The weather experts assert that these 17 countries could experience heavy economic losses from climate-related water scarcity – up to 14% of GDP by 2050.

It is also estimated that 3.5 billion people could experience water scarcity by 2025, which is just 3 years from now. Kerala too might be on the verge of serious problems beyond 2050.

The LISSAH campus has a clear plan of water management and actions required to avoid any dependence on water supply from outside the campus. The quantities involved source-wise are in Table – 2.3.1.

	Source	Details
1	KWA/Panchayat Water Supply	No
2	Own Wells	4
3	Pond/Rain Water Harvest	3 + 1
4	Other	None

Table 2.3.1: Water Sources for LISSAH

No	Item	Details
1	Water pumps: Electric	3 x 1.5 HP + 1 x 2 HP
2	Overhead Tank, Capacity litre	55,000 L
3	Pumping hours	3.45 hr/day
4	Total water supplied daily	37,500 LPD
5	Other arrangements	Rainwater harvest Collection pipes

Table 2.3.2: Water Pumping System for LISSAH

Block	Source	Pax. Using	Avg. min/pax	Flow/min in (L)	*To Drain	*To Open	*Treat & Reuse	*Soak Pit %
Admin	Well	158	10	3@	--	--	--	100
Auditorium	Well	225	10	3	--	--	--	100
Library	Well	220	10	3	--	--	--	100
Hostels	Well	70	30	3	--	--	--	100

@ Hand/Face/Floor/Utensil : Wash by Students and Staff
*Percent Disposal

Table 2.3.3: Water Use Pattern: Student Survey result for LISSAH

Place of Leakage	Water Source	Water Loss/min (Litre)
15 Places	Well water	0.135

Table 2.3.4: Water Loss through Pipe Leak in LISSAH

No.	Water Used for	Per Day Total
1	Toilet flushing	2,800 LPD
2	Cooking	600 LPD
3	Utensils Wash	800 LPD
4	Floor Wash	200 LPD
5	Gardening	11,000 LPD
6	Bathing/Personal cleaning	12,500 LPD
7	Other/	100 LPD
8	Other/Occasional	- LPD
9	Loss thro'- tap leaks	200 LPD
10	Loss thro' pipe break	0 LPD
	Total	28,200 LPD

Table 2.3.5: Water Consumption – Students' Assessment
(Off by -25% from actual figure of 37,500 LPD)

No	Building	Taps	Single tap unit	Multi-tap unit	Bath Room	Toilet	Toilet Special
1	Administrative Block	7	12	--	10	5	2
2	Auditorium Block	9	17	1 (4)	15	8	--
3	Library Block	14	6	--	16	16	5*
4	Hostel 1	30	35	--	22	22	--
	Total	60	70	1(4)	63	51	7

- Gardening

Table 2.3.6: Water Outlets – Distribution in LISSAH Building-wise

Separate water meters are not provided at the LISSAH premises and therefore, the Student Green Guardians have collected data on water use for the green audit. The various functionalities for which water is utilized in LISSAH is assessed by the student volunteers through surveys and sample measurements taken at user end - limited observation on water use by 10% of the student strength and extrapolated. The actual data as per official records of total consumption are given in Table 2.3.2

As per the actual data as above from the metering system the per capita water consumption of LISSAH is 50 LPD. Roughly 90 LPD for residents and 25 LPD for day scholars, staff members and visitors, which is quite adequate.

Filtered water is supplied at all outlets at LISSAH

One of the multiple tap units

Auditing under expert guidance in progress

Observations and Suggestions:

1) Bureau of Indian Standards BIS 1172-1993 had set a per capita LPD of 100-150 for India, which in its 1998 revision has reduced this to 70 LPD per capita. The benchmark set for urban per capita water supply in India is 135 LPD. The water audit finds the arrangements including the sourcing, purifying, recycling, and judicious use of water in Little Flower Institute of Social Sciences and Health are quite in order. This is a model for other Colleges in the region to follow.
2) There is no adequacy problem in the campus at present on quantity or quality. Copious supply is ensured.
3) Conservation of water through effective rainwater harvesting is practiced by the campus community. The harvested rainwater is taken to the artificial ponds and pumped for water filtration, purification and distribution.
4) The water quality, as proved by testing at intervals is acceptable. However, attempt should be made to obtain annual test certificate from a statutory laboratory.
5) The rain water harvesting may be extended for irrigating vegetable cultivation as well as for the garden land, using Solar pumping mechanism.

2.4. CGH – Clean, Green and Healthy – Audit

[Waste, Transportation, Health & Environmental Quality]

The 7.28 hectare campus of LISSAH at Kaithapoyil, Thamarassery, in Kozhikode district had at the time of its inception paid adequate attention to develop it as a greener, serene, and resource conserving environment, prompting an ethical attitude in the minds of its students. A healthy environment always help in having good bodily health and sound mental health and sharpness in thinking.. The health of Planet Earth can ultimately be ensured only through a 'Clean, Green and Healthy' way of life by its living occupiers. Animals do not attempt to change the environment; rather they conform to it. It is the duty of human beings to respect the laws of nature and try to lead a way of life very close to Nature. The Nature as we understand is 4.5 billion years old, and the continued good health of Nature is very crucial for our sustenance. The future citizens are, therefore, not to deviate too far from Nature's "limits of tolerance". The present day lifestyles create problems of wastes, and add pollution to the environment through various ways. The CGH audit is to ensure that the 'learning environment' for the students of the audited campus is of the right type, and healthy and in other words 'Green'.

2.4.1. Waste Audit

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

Building/Block	Plinth Area (Sq. m.)	No. of Floors	Roofing Pattern:
Office Block	1,642 sq. m.	3	Concrete Sloppy + Conc. Flat
Auditorium	2,300 sq. m.	3	Concrete Flat
Library Block	2,628 sq. m.	3	Concrete Flat
Play Ground	4,000 sq. m.	--	
Hostels	sq. m.		
Total land area	72,800 sq. m.	--	

Table 2.4.1.1: Details of Land and Buildings

There are differences in quantity of wastes generated between workdays and holidays, as well as between seasons, as two-thirds of the total campus community of 749 are in the campus only during daytime and on working days. An average figure of wastes per person per day for LISSAH activity type, is however worked out by observing students' activities through a sample survey for a week by the student volunteers,

and inspecting the disposal area, quantifying the measured wastes, and then extrapolating for the whole campus.

Hostel Name/ Area	Number of students	Number of Bath-rooms + Toilets	Number of Floors	Numbe r of Rooms	No. of garbage bins/floor	No. of garbage bins per building
Hostel 1	45*	17	2	19	5	10
Hostel 2	25*	10	2	14	5	10
College	693	47	3	57	16	50
Total incl. staff	749	74	7	90	26	70

(*) as on date of counting

Table 2.4.1.1a: Waste collection receptacles

Sl No	Type of Waste Practice	Qty. kg/day	Type of Disposal	Remarks
1	Food Waste by Students & Staff	25	waste pit & bio gas	Try: Full biogas conversion
2	Food Waste: Canteen + Hostel	40	waste pit & bio gas	Try: Full biogas conversion
3	Paper Waste by Students & Staff College	0.5	scrap dealers	Okay
4	Paper Waste Bulk: Canteen + Hostel	0.5	scrap dealers	Okay
5	Plastic Waste – Individual	5 g	Collected by Panchayath	Okay
6	Plastic Waste – Bulk: Canteen+ Hostel+ Office	0.5 kg	Collected by Panchayath	Okay
7	Glass & other utensils: Canteen+ Hostel+ Office	1 kg/month	Collected by Panchayath	Okay
8	Electronic Waste: Canteen+ Office+ Laboratories	5 kg/month	Collected by Panchayath	Okay

Table 2.4.1.1b: Waste collection receptacles with Audit Remarks

Location	Total Gen/day kg	Major Items	]Disposal through Local Body	Disp. in public area	Disp. in Land fill	Bur n	Recycle /reuse
College	5 kg/ month	Computers, Printers, CD, Bulb, Tube, Battery	100 %	--	--	--	'--

Table 2.4.1.1c: Electronic Wastes disposal

No.	Item-Material	Unit	Quantity
1	Paper A4 80 gsm sheets	No.	100
2	File pad	No.	5
3	File Cover	No.	5
4	Paper Cups	No.	200
5	Paper Plates	No.	--
6	Other Paper Items	No.	1 bundle tissue
7	Printer Cartridge	No.	1/month
8	Pen & other items	No.	100

Table 2.4.1.1d: Paper Wastes data

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. These are used in evaluating data on wastes in the LISSAH campus as well. The summary of Data Sheets on Wastes with Auditors' Remarks is given in Table 2.4.1.1.

The wastes generation in the LISSAH campus is at a moderate level, in view of the rigorous lifestyle training – given to the students. Wastes are systematically collected and disposed of, through means suggested by the local government. Wet wastes are digested in the single large biogas plant (referred to in Renewable Energy use audit). The energy obtained is used for cooking. Solid and liquid residues are used as manure in the widely distributed greening efforts.

The biogas plant produces 8 cum of methane gas for cooking purposes. This is a very practical, double edged approach, where wastes are removed from the scene without delay, thereby contributing ecological benefits like reduction in carbon footprints, and on the other hand providing heat energy for cooking, and replacing several cylinders of LPG every month. However, a realistic estimate of the bio-degradable wastes available in the campus may be made before the next audit, and a comprehensive plan for utilizing the entire downstream bye-products of the biogas plant and their optimal use in the campus can be made. Adequate numbers of small garbage bins are provided in hostel rooms, as well as in the office and academic areas.

Observations and Suggestions:

1. Using waste paper for value added recycling could be seen in getting paper pulp out of it, and to make handmade cards (with designs) and encouraging students to use them as Greeting Cards, or for making Sign Boards during events, etc.
2. Napkins disposal facilities may be reviewed. With the dispersion of toilets, its direct link to the napkin dropping facilities should be examined.
3. The glass wastes are generated on a very limited scale, as of now & safely removed.

2.4.2. Transportation Environment Audit

It is very difficult for Colleges in Kerala to reduce carbon footprint due to transportation., as these higher education facilities serve a widespread population spanning two or more Districts. The data on the number of people using public and personal transport are collected by the student green guardians.

Students/Staff coming in Own/Hired Vehicle:

1. Motor bike/scooter (single, shared) Per day
   - o No. of Motor bike/scooter : 60 single/shared
   - o No. of Students : 82
   - o Total km travelled/day (To and fro) : 1800 km/pax
2. Auto Rickshaw
   - a. No. of Auto Rikshaws used : 10
   - b. No. of Students : 15
   - c. Total km travelled/day (To and fro) : 05 km/person
3. Own Car (single, shared)
   - a. No. of Own cars : 12
   - b. No. of Students : 02
   - c. Total km travelled/day (To and fro) : 350 km to and fro/car
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 : Nil
   - b. No. of Students : Nil
   - c. Total km travelled/day (To and fro) : Nil
6. Public Transportation (Bus & Train)
   - a. No. of students : 250
   - b. Total km travelled/day (To and fro) : 6250 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 : 350
   - b. Average km travelled by person/day : 1 km/pax to & fro

Educational Institution Vehicles Operated during the Academic Year 2020-21

Car/Bus Nos.	Average No. of Persons per trip	Total distance travelled during one day (km)	Fuel Consumed (Litre)
Bus: Nil	--	0	0
Car: 1	--	10,000 km for the year	Petrol: 625 L

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 2.4.2.1: Transportation data for LISSAH

The predominant mode of transportation for college students in Kerala is bus or train. But, travel of students and employees to and from the campus has to be inexpensive and as comfortable as possible, for which college buses and public transport facilities should be conveniently accessible. In limited cases, they travel by bicycle or even may walk. 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 earth and on our own environment. Accurate assessment of such environmental damages is a time-consuming exercise.

At LISSAH - Walking to a cloud kissed campus is pleasure

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 how much burden each one is inflicting on the environment, and try to bring such impacts to 'near zero' through all possible remedial actions. 'Simple living' and 'Greener travel' generally help in keeping a' low carbon footprint' profile.

The Indian transport sector is contributing 13.5% of India's energy related CO2 emissions (According to International Energy Agency – 01 December 2020). It is the Road transport that is responsible for 90% of total final energy consumption, with rail as well as domestic aviation adding 4% each.

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 resources 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 Institute,

specific transportation details as at Table 2.4.2.2 were gathered by student volunteers through a survey.

Sl. No.	Details: Type	No. of Vehicles	No. of Staff/ Students	Total Travel km/day to & fro
1.	Motor bike/Scooter (Single/Shared)	60 (10 shared)	82	*1800 km
2.	Auto Rickshaw used	10	15	50 km
3.	Own Car (Single/Shared)	12	16	350 km
4.	Car - Visitors/Parents	Nil	--	--
5.	Van/Mini Bus	Nil	--	--
6.	College Buses	Nil	--	--
7.	Public Transport/Bus, Train	Public	250	6,250 km
8.	Cycling to College	--	None	--
9.	Walking to College	--	350	350 km

Carbon Footprint calculations are at Chapter 4; *No. of days taken as 250.

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

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

1. Parents and occasional visitors generally use public transport; Own car or taxi is used 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 bus users, there are private-bus, and public-bus service users.
4. The management allows the hostellers to choose their own mode of travel for occasional family visits.

Observations & Suggestions:

1. Audit suggests that a more precise assessment of the mode of travel, daily 'to and fro' distances involved, etc. through future surveys. The distance range of bus users may be re-classified into 2 or 3 distance ranges close to the clusters identified: [Say, Number within 6 km, 10 km, etc.].
2. The distance range of cars and scooters used by staff and students for commuting daily may also be studied with better precision. The detailed individual data may be assorted and analysis done. Vehicle sharing option may be further encouraged.
3. Awareness on the benefit of using e-vehicles may also be propagated more vigorously.
4. Every motor vehicle owner may be reminded to plant additional trees within any greening exercise inside or outside the college campus, and/or around their own homes. They can easily make it through their involvement in outreach activities of the Institute.

2.4.3. Health Audit

Greening of college campuses is primarily to ensure that the students are able to live and learn in as best a healthy environment as possible. Parents generally count on the institution to offer their children lavish facilities for developing their physical and intellectual capabilities to the full.

The method adopted by NGGFn for assessing the physical well-being of the students of educational institution under Green Auditing, checks the following four aspects:

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

Observations on these aspects in respect of LISSAH, Kaithapoyil for 2020-'21 are:

Sick leave: There are only a few cases on record, indicating that this is an environmentally healthy campus. Kerala is known for its low mortality and high morbidity status in comparison to the national health status. This is because most mothers are educated, and so even a minor headache is promptly taken to the notice of, at least the nearest primary health centre, or a government or private clinic/hospital.

Common cold and minor flu usually affect some of them occasionally, and these interrupt their undivided attention to classes. During the audit year, the entire State was under COVID threat. The students, even of PG courses, and several staff members of LISSAH are active in environment-related programs, as well as in cultural activities, as also sports and games.

Medical Centre:

There is adequate 'First-Aid' facility in the campus to attend to any casualty, including to visitors. Advanced and Specialist services or referrals are arranged with the nearest hospital – Karuna Hospital - on priority, which is only 3 minutes away from the Institute by car. Transportation facilities are offered free for the students for emergency medical consultations.

In addition, Homeopathic and Ayurvedic hospitals nearby are also accessible for those who are particular of getting non-allopathic treatment for any particular ailments or conditions.

Distance to the designated hospital

Vaccinations: LISSAH regularly arranges medical screening and check-up camps for the students. They are also monitored for their vaccination status for COVID-19, Hepatitis, and other vaccinations, and provided with such services within the campus premises when situations warrant.

Mentoring and Counselling: The Mentorship program of LISSAH is to provide comprehensive monitoring and mentoring system for the students, with the teacher - student ratio of 1:18. The duty of the Mentor is to regularly interact with their mentees, and provide comprehensive solutions for the problems noticed.

Healthy body hosts a healthy mind

Sports & Games:

The LISSAH college is gradually getting noticed as an institution where the talents of the students in sports and games are nurtured effectively. It has a growing sports infrastructure for several of the items of competition which the Keralite youth generally get engaged in.






Observations and Suggestions:

1. Audit finds that the infrastructure for sports and games created in the campus is adequate enough, and even inter-institutional contests were hosted by LISSAH prior to COVID interruptions. The students have won several contests, especially since the catchment area of the college is a hilly terrain and the youth are well exercised.
2. Documentation on physical education and healthcare may be more systematized.

2.4.4. Environmental Quality Overview

The environmental quality of LISSAH as a higher education centre in the outskirts of Kozhikode city (~40 km) have its natural environment maintained very well. The Director, Principal, members of teaching staff, and students, as well as the management are very active in conserving the nature, in moderating consumption, and in appropriately reusing and recycling materials, water, etc. wherever possible. This may be due to the following factors:

1. LISSAH has from its beginning been very conscious of ensuring safety and serenity of the learners in a campus of this kind.
2. The concept of 'conservation of resources' has been driven deep into the minds of teachers, with them driving the co-curricular and extracurricular activities for this philosophy to be imparted to the students.
3. Available water sources are exploited at a sustainable level for eg., Rainwater harvesting is done enthusiastically. Opportunities to enhance these positives do exist and is currently planned to be strongly developed.
4. The 2018 'Great Floods of Kerala, and landslides and excess rains of 2019 did not inconvenience the campus in view of its lay of the land; but the staff and students could help those who were affected in multifarious ways utilizing the youth power in the campus and the available resources of the College.
5. On the whole, the LISSAH Campus is seen to possess a good environmental quality conducive to serious learning by the students of all branches of studies.

Nature club/Club Green Guardians

At LISSAH, Nature club as a conservation promotion program was initiated almost from the start, composed of a couple of students and one or two staff members, who can practice conservation through the extensive gardening program underway.

LISSAH is actually set amidst greenery blessed by nature's bounty. The campus profile has been planned to enrich the natural endowments. With the starting of "Club Green Guardians (CGG)' in 2019, this promotional activity is now safely in the hands of students, branding the institute as in a journey from 'Green' to 'Greener'. The CGG is instituted with the objective of promoting, operating, and monitoring environmentally sustainable activities including love for nature and passion for protection of environment. The current year also, despite having COVID disruptions all over the world and in the State, students enthusiastically participated and monitored activities such as tree planting, waste water treatment, rain water harvesting, pisciculture, and landscaping.

Club Green Guardians: Structure 2020-21

The Club Green Guardians of the College is reconstituted for the year 2020-21 with the following members under 4 programs:

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1	Nysha E P	BSW	9544508142	nyshaepbsw20@lissah.com
2	Shimna P Z	BSW	9961603763	shimnapzbsw20@lissah.com
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Faculty - in - charge		**Shiju Elias**		
		Cissa M George		

Program 1

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		Biju Mathew		

Program 2

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Faculty -in- charge		Sushina M		
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Program 3

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4	Tony Mathew	BA	7909166364	mathewtonyba20@lissah.com
5	Sherin B Cherian	BA	9037347990	sherinbcherianb20a@lissah.com
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7	Jesline Joseph	BA	7034559413	jeslinejosephba20@lissah.com
8	Sulaikha Nafbeen	BA	9747117742	sulaikhanafbeenba20@lissah.com
9	Ajith Anto	BA	8590468892	ajithantoba20@lissah.com
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Faculty -in- charge		Nimisha George		
		Namitha Babu		

Program 4

Data Consolidation Team	
Vincy Abraham	*Subin Varghese*
Merin Joseph	*Jisha Thomas*
Balasubramaniam	*Melbin Thomas*

The College campus, roads, walkways, and gardens are all clean, green & well-kept .

The students cooperate with the management to keep the entire premises maintained litter free, plastic free, noise free, and every inch of land green topped with lawns, turfs, hedges and tree canopies.

The vehicles used for outreach activities like NSS camps, tree plantation missions and others are also maintained meticulously clean, and the camps are organised in exemplary manner. This is the right message to the community that this higher educational institution can pass on. The officials of local governments are often in contact with the LISSAH community on several issues, and this trend needs to be continued for passing on lessons on environment and development.

2.5. Audit on Societal Commitment, Outreach & Promoting Green

The students in colleges, especially undergoing degree courses 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 the very survival of our planet Earth is in danger.

A committee similar to IPCC on Climate Change, under the name "Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services" (IPBES) had its 7th session in Paris in 2018 with 132 nations attending, and the findings of it in its 1500-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 last 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 in many countries.

At LISSAH, such commitments are honoured by the students through: 1) Activities under NSS, and 2) by maintaining the well-designed campus in harmony with the natural environment through nature conservation teams. They also participate in several camps, contests, and awareness programs, as well as conduct flash mobs to sensitise the community on several issues having social consequence.

Leading in Blood Donation

Regular in Community Interaction ->

2.5.1. Expression of Societal Commitment

LISSAH, as one of the recent entrants to the higher education scene in Kerala have been doing a lot of social work under the banner of National Service Scheme, and also as departmental outreach activities. The management is also very particular that the area adjacent to the college which is a prominent tribal inhabited area should effectively interact with the community. Such activities are coordinated by one or more members of the teaching staff and by the active student volunteer leaders. It has also declared concessions for students coming from such communities.

Blood Donation and Other Activities

Activities include: Protection of the elderly, post-flood care of habitats and local habitants, waste management training, ecological restoration activities, tree planting, etc. The activities of 2019-'20 included (the immediately previous year to the COVID torn current year), covered the following, but not limited to these alone:

I. Annual Blood Donation Camp, Blood testing camp
II. World Blood Donation Day
III. Environment Protection Rally
IV. Flood Relief Camp
V. Mosquito Source Reduction Drive
VI. Tree Planting drive
VII. Teachers' Day; Republic Day; Gandhi Jayanthi; NSS Day
VIII. World Environment Day
IX. Women's Day
X. Zero Waste Campus, Plastic Free Campus, etc.

2.5.3. Promoting Green Strategies

For promoting green strategies, LISSAH operates through the academic departments of the college with their own Faculty and also with experts from outside, and weave canvases of green areas which the community can easily maintain subsequently. The campus is maintained plastic free through the adopted green protocol, and meticulous student volunteering based on a comprehensive plan to exploit even the green resources hidden within the campus.

Regular Yoga sessions in progress attended by a majority of male and female students

While a large number of students are regularly facilitated to do Yoga exercises in groups at the college as a means of promoting green strategies, this will be very beneficial for the girls when they grow up as women managing families.

Suggestion: Since there is a reasonably good vegetation and tree cover in the e campus, it may be worthwhile to jointly develop a Biodiversity Park, enriched by Miyawaki model fast afforestation techniques, and also by selectively introducing rare native species of medicinal plants and other trees.

3. Audit on Accessibility and Gender Justice

3.1. Built Environment and Accessibility Audit

LISSAH, Kaiothapoyil, Thamarassery in Kozhikode district of Kerala has during the Audit Year 2020-'21, a student strength of 693. The total campus strength is 749.

Accessibility: There is only one differently-able student currently studying in LISSAH, against three last year. with locomotor disability. Students with physical, mental or visual challenges have great consideration from other students as well as from the management. The institute has already agreed to conduct a special accessibility audit by an expert during the next AY, i.e., after the COVID restrictions are withdrawn.

The current preparedness status is given in Table 3.1

No.	Accessibility Checkpoint	Data
1	How many gates? How many are accessible/wheelchair entry type?	Two gates and both are wheelchair accessible
2	Any tactile marked lines for visually impaired persons?	No
3	Foot paths with wheel Chair marks? Foot path with tactile lines?	No
4	Total no. of buildings? Multi-storey buildings?	3 blocks All are multi-storey (3 floors)
5	Building – 1 (Administrative Block)	
a	Ramps with wheel chair accessibility	Yes (applicable for all three blocks)
b	Tactile marking	No (applicable for all three blocks)
c	Accessible Toilets	Yes @ Ground Floor (applicable for all three blocks)
d	Accessible Ladies Toilet, Floor	Yes @ Ground Floor (applicable for all three blocks)
e	Accessible furniture (on demand)	Yes (applicable for all three blocks)
f	Signage	Yes (applicable for all three blocks)
g	Accessible parking	Yes (applicable for all three blocks)

Table 3.1: Information related to preparedness for differently able inclusiveness

every building)		
6	Accessible Library	Yes
a	Computers with screen readers	No
b	Accessible Books	No
c	Print to Text conversion facility	No
d	Trained Staff (on Accessibility)	No
7a 7b	Location of Information Office Location of Documentation Centre	Administrative Block- Ground Floor Library Block- Ground Floor

Number of differently-abled (*Divyang-jan*) students, teachers, and other staff during the Current Year (M+F)	:	1 Male Student

No.	Type of DP	No.	Gender	Age	Course studying
1	Locomotor disability	1	Male	20	BSW (First year)

3.2. Rest Rooms Accessibility Audit

There are special toilets with accessibility considerations for differently-able persons now. Ramps for independent self-navigated wheel chair entry are also in position. n

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. LISSAH is partially equipped for such demands, but is planning for providing improved international signage and guidance, including floor signs according to international standards. Further, the D-A assistance when needed, should start from the point of entry through the security guards, and later through the Information office, which should also be close to the main gate. The CGG and NSS volunteers are to be trained in 'Mobility' practices on how differently able persons are to be assisted, guided, or briefed. This should be extended to students joining environment related clubs and groups, as well as to all newly joining members of the faculty too. The College is advised by the Audit to follow the international non-linguistic signs to be used in Signage works.

Accessibility enabled thro' gentle ramps in all buildings at LISSAH

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 plans for toilets, ramps etc. should follow all the accessibility norms while upgrading facilities for the *divyang jans*.
2. A special workshop may be arranged during the next available opportunity on how others 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 organized with an accessibility specialist as the invitee speaker.

3. 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.
4. Like having fire safety training (even when there has been no history of fire hazards), accessibility training to all levels of employees in administration should be imparted every year to make the campus fully safe to "*divyang jan*s".

3.4. Audit on Introduction of Assistive Technologies

LISSAH needs to keep accessible software as up-to-date for access to the main library, or appropriate screen readers for computers. Also, it is better 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 ready with assistive technologies, duly updated when increased needs arise in future.

Observations & Suggestions:

For accessibility audit, accessibility/mobility training, and for free consultation on assistive technologies, the designated Staff may contact the Charitable Trust working in this area for the past 12 years, and having active R&D link with Assistech of IIT Delhi, and other national and international institutions, by name "Chakshumathi", Vellayani, Trivandrum 695 522

[e-mail: ramkamal@chakshumathi.com].

Contact: +91 98470 60034 (What's App No.)

3.5. Focus on Environment in Outreach & Social Service

For healthy living, environment plays an important role. A famous quotation attributed to an influential writer Ayn Rand says: that the difference between animals and humans is that "animals change themselves for the environment, but humans change the environment for themselves". Environment is just like our neighbourhood, the surrounding state of the environment influence us, and also tend to modify our growth and development. Flash Mob by LISSAH girls on Water Day:

All outreach and NSS programmes of LISSAH are heavily weighted towards environment and sustainability related observances, interactions, and learning opportunities. The students are also showing great interest in this direction as well as partaking in large numbers – within and outside the LISSAH campus.

World Water Day – Interacting with the people

Mazha Nadatham (Rain Walk) – An innovative youth program

3.6. Audit on Universal Information and Enquiry Systems

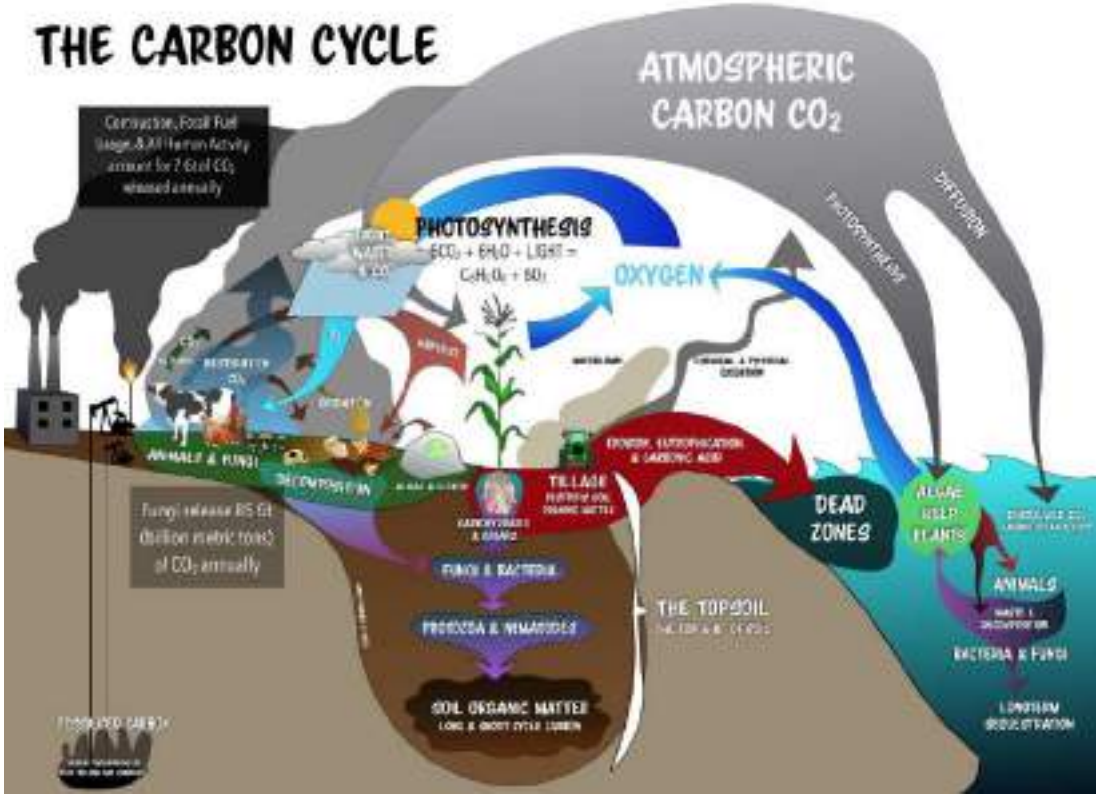
The present arrangement of first interception for any visitor, parent or student at the LISSAH campus is the Principal's office. IQAC room and the Information Desk/Centre are not closer to a visitor. This should be improved appropriately.

With the present-day affinity to social media, the College can transfer several details required by prospective students and employees to the online platform and social media. With the proposed accessibility audit, the College will be able to present a more accessible campus at Kaithapoyil.

Focus: All round development of the students and their talents at LISSAH

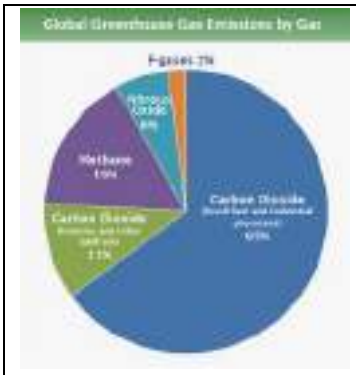
4. Carbon Footprint

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 (CF) is the total amount of greenhouse gases (GHGs) 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."

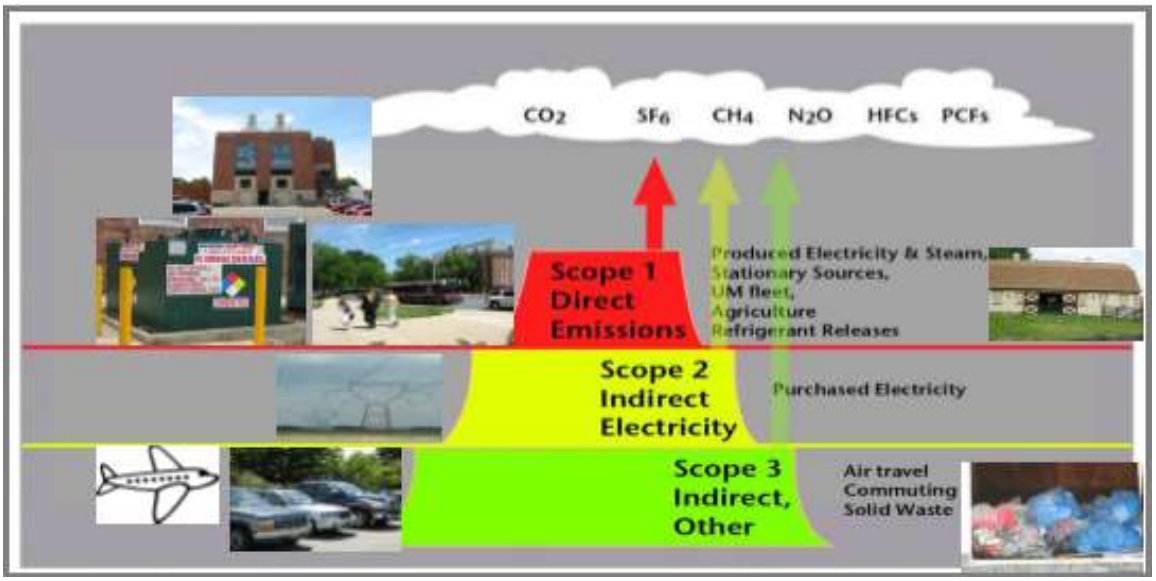
"Our earth operates in cycles and feedback loops. We need to slow down, observe, and make wise decisions about energy, storage, and creating surpluses". "We are dealing with an 'Oxygen problem' as much as a stagnating Carbon cycle". The whole world knows that Carbon is an essential element, and that 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 – that too 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 decreasing 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 cause 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 under the general title '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 by British Petroleum (BP) Corporation under one of their campaigns in 2005, presumably for some self-interest.

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 convinced that the calculation of carbon footprints for many widely used products is in effect a very "complex job".

The smart phones now being used very widely is a typical example. 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 data, time, energy, and resources. It is not worth the trouble and time to go for such detailed study – just to know the CF.

Before calculating the CF of an institution, industry, product, event, or service, it is essential that we understand the task ahead as 'complex'. The efforts to obtain the same should then only 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 Little Flower Institute of Social Sciences and Health, in Kozhikode district 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 correct level, or even aim at 'excess' remediation. 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 do not want to use 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 the present Green'.

The team assessing the CF knows that very tedious procedures involving continuous monitoring throughout the year is required to obtain a precise measure of the damages to the environment, and this is not warranted. This green audit by NGGFn, therefore, is employing only empirical measures that quantify the ecological footprint to a reasonable accuracy, and suggest simple remediation measures within the reach of the institution, that would neutralise the impacts completely or to a substantial level. It also looked at the possibility of taking the positives present within reach, to levels a little higher than what is required. As the major contributors of damaging impacts are the higher number of stakeholders, their nature of consumption, and the transportation modes requiring fossil fuels, the approach for this Green Audit is to use empirical constants on the quantities arrived at for the major contributors. Remediation is to depend on expanding the available positive factors. Creating awareness to the entire campus community on these and getting them to contribute voluntarily will be an effortless change in lifestyle, on which the institution as a whole can feel contended and be proud of.

Data Obtained from Component Audits

Component Audits in the 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 of the institution
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 items] 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 towns 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 km run as at assumption 4.
6. For an auto rickshaw, the fuel needed 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. of lawn area 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 used is assumed to have not more than 10-20% moisture.
15. Contribution of events & festivals in the campus to CF is based on the no. of events, no. of participants, and the extent of high emission level festivities.

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, Students, 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_2eqvt.) 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
LISSAH College, Kaithapoyil, Kozhikode Dt., Kerala for 2020– 21

Sl. No:	Source	Rate	Quantity x Days/year	Total Quantity	Annual Eqvt. CO_2
1.a	Electricity use	0.82 $kgCO_2$/kWh (India in 2018)	2.568 MWh/month	30.8 MWh	25.3 T CO_2
1.b	Fossil fuel use	2.68 $kgCO_2$eq/kg 2.30$kgCO_2$eq/kg	LPG (3x19 kg)	0.75 kL 0.057 kg	2.0 T CO_2 0.0 T CO_2
1.c	Firewood	1.8$kgCO_2$eq/kg	60 kg/d x 300	18.0 T	32.4 T CO_2
2.a	Food waste	1.9 $kgCO_2$eq/kg	65.0 kg x 300	19.5 T	37.0 T CO_2
2.b	Paper waste	1.725$kgCO_2$eq/kg	0.5 kg x 250	0.2 T	0.4 T CO_2
2.c	Water waste	0.298$kgCO_2$eq/kL	8.0 kL x 250	2,000 kL	0.6 T CO_2
2.d	Plastic/Other	6.0$kgCO_2$eq/kg	5.5 kg x 250	1375 kg	8.3 T CO_2
3.a	Bus/Train: Students and staff	2.68 $kgCO_2$eq/L	250x.8 25x250/(50x4)	7.8 kL	20.9 T CO_2
3.b	Student weekly trips	2.68 $kgCO_2$eq/L	--	--	0.0 T CO_2
3.c	Cars, Taxis	2.30 $kgCO_2$eq/L	(12x30)x250/10	9.0 kL	20.7 T CO_2
3.d	Auto rickshaws	2.68 $kgCO_2$eq/L	10x5x250/30	0.4 kL	1.0 T CO_2
3.e	Two wheelers	2.30 $kgCO_2$eq/L	60x30x250/50	9.0 kL	20.7 T CO_2
4	Events & Festivals	Approx.	1000x8x1.2	9,600 kg	22.0 T CO_2
5	Construction	Lump sum	--	--	0.0 T CO_2
	Total				**191.3 TCO_2**

**No. of activity days in 2020-21: 250 days*

Table 4.1:Calculation of Carbon Footprint Source-wise

Remediation for Carbon Footprint
LISSAH College, Kaithapoyil, Kozhikode Dt., Kerala for 2020 – 21

Sl. No:	Source	Rate	Quantity x Days/year	Total Quantity	Annual Eqvt. Saved 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 2.3 $kgCO_2$/kg -- `	6 kW Nil Nil 8 cum/day None	9.9 MWh -- -- 2400.0 kg --	8.1 T CO_2 -- -- 5.5 T CO_2 --
2	2.a. Replacing old tube lights 2.b. Replacing bulbs & CFLs 2.c. Replacing Fans, Motors 2.d. UPS Upgrading 2.e. Reduce Phantom load	0.82	20x0.032x6x250/1000 None None None	0.96 -- -- -- --	0.8 T CO_2 -- -- --
3	3.a. Waste Reduction 3.b. Recycling 3.c. Waste to Energy	0.26$kgCO_2$/kL	15kL/day Limited No other	4,500 kL -- --	1.2 T CO_2 -- --
4	4.a. Sharing of vehicles 4.b. Low footprint options 4.c. Electric/Solar vehicles		6 car + 20 bike	LS -- --	3.0 T CO_2 -- T CO_2
5	5.a. Greenery forest retained 5.b. Tree planting, Biodiversity 5.c. Gardens, Lawns, Trees, etc.	Nil 22kg/yr 2200 kg/acre	Per acre/yr. --	-- -- 0.46 acre	0.0 T CO_2 14.9 T CO_2 3.6 T CO_2
6	6.Walking & bicycle use (40+30)	2.68 kg/L Avoided	350x1x250/50x4	438.0 kL	0.4 T CO_2
7	7. Outreach activities	22 kg/yr	300 trees	50%	3.0 T CO_2
	Total				**40.5 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)*

GREEN AUDIT OF LISSAH COLLEGE, THAMARASSERY

Kaithapoyil, Kozhikode, 673 586, Kerala

Carbon Footprint Analysis and Evaluation for 2020-'21

The actual per capita carbon footprint for Little Flower Institute of Social Sciences and Health, Kaithapoyil, Kerala is 252 kg (0.252 Ton) of CO_2 equivalent [191.3 Ton/(749+11 visitors], and through remedial routes 40.5 T of CO_2 T is compensated. The net carbon footprint during 2020-'21 is thus [191.3 – 40.5 = 150.8 T CO_2 eq.].

The effective CF is 151/760 or 0.198 T or 198 kg CO_2 per capita [2020-21]

According to the Economic Survey of Govt. of India, the per capita emission for an Indian is 1.84 Ton $CO_{2\ eq.}$ per annum in 2021. The projection is that it will reach 3.0 – 3.5 T of CO_2 by 2030 (as per recent evaluations). India's efforts for greening is progressing very well and therefore a reduction from the expected CF level is now around 5%.

For the year 2020-'21, for LISSAH College, Kaithapoyil, Thamarassery, Kozhikode District, Kerala, the Carbon Footprint per capita at 0.198 T CO_2 equivalent, is very modest. This is achieved due to the minimalistic way of life preached by the leaders of the College, and followed by the students who have a predominant rural background.

The campus can be treated as a 'low carbon footprint' institution.

The remediation gap between the assessed footprint and the available remediation is 151 T CO_2 eq. On a closer look, the major contributors are:

1. Transportation (63.3 T of CO_2)
2. Energy Use (57.8 T of CO_2) = *Use of Firewood (32.4 T of CO_2) + Use of Purchased Electricity (25.4 T of CO_2)*
3. Food Waste (37 T of CO_2)

The College may consider several remediation options, even in the face of its very low CF status. First and foremost, being in the foothills of western ghats, transportation requirements cannot be much reduced. However, for personal vehicles, e-mobility may be seriously encouraged.

On the energy front, there is heavy dependence on firewood for cooking. More efficient and ecologically better sources may be introduced. Though solar electricity is just entering the campus, there is enough opportunities to expand the solar PV System, coupled even with solar water heating as a supplementary heat source, and wipe off the entire carbon footprints the campus has now. This can be achieved even within a single year ahead.

There is ample scope for improving energy efficiency and save very much on energy costs.

5. Future Directions

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

Strengths and Weaknesses:

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

Opportunities and Threats:

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

Points for Consideration:

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

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

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

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

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

SWOT Matrix

for a "Greener LISSAH" at Kaithapoyil

S	W
Strengths ➢ LISSAH community practices a Green Protocol and the newcomers are groomed to follow it ➢ Students and Staff help in having a litter-free campus ➢ Rain Water Harvesting, and Waste reduction are already in practice with students' support ➢ The College Club Green Guardians is established and activities started ➢ Community links for outreach activities are very strong – NSS & Departments	**Weaknesses** ∞ Due to location in a rural and hilly setting, positive factors get delayed for access ∞ More than half of the students are available only during working hours (day scholars), limiting the student contributions ∞ More students and faculty are in programs outside of life science streams limiting the chances of integrating greening as a part of curricular work in the College ∞ Sensitization and awareness creation are planned department-wise
O	**T**
Opportunities ❖ There is ample opportunity for expanding the use of renewable energy, in turn for reducing or wiping off the carbon footprint gap ❖ There is still 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 is possible with the joint efforts from academia available in other institutions in the district and the Malabar Botanic Garden in Calicut	**Threats** ⊕ Continuous care and support from day scholars are difficult to ensure ⊕ Repeating the campaigns and training annually is necessary ⊕ Increase in the no. of students from faraway places tends to boost the carbon footprint ⊕ The increase in the types and quantum of e-wastes, and lack of facility for processing them is a growing threat ⊕ Climate change impacts in Malabar region is on the increase, posing added threats to greening activities