A Green Audit of JSS Campus, Dharwad

Ratna V Airsang[1], Pooja Kambar[2], Shweta Ganiger[3] and Keerti[4]
JSS Banashankari Arts, Commerce and Shantikumar Gubbi Science College, Vidyagiri, Dharwad-580004

Abstract: **Green auditing of the Institution is crucial in order to assess the environmental performance of educational Institutions and to consider the potential options for turning the educational campus into an eco-campus. The JSS college, Dharwad, has undergone a green audit to evaluate its environmental impact. The main purpose of study is to explain the way in which environmental audit contributes to improving and preserving environmental protection for sustainable development. A survey work was carried out to learn more about resources in the campus and their consumption. During the study, environmental factors like quality of water, soil, noise were examined which were collected from various sites of the college campus and analysed for their characteristics and even, an attempt has been made to record flora and fauna.**

Key words: Environment audit, flora, fauna, physico-chemical analysis, Waste disposal.

INTRODUCTION

An audit is a systematic, independent and the documented process for obtaining in evidence and evaluating it objectively to determine the extent to which specific criteria are met. A Green Audit is also known as environmental audit or sustainability audit, is a comprehensive assessment of an organization operations, practices and policies to evaluate their environmental impact and identify areas for improvement (2022, RSB). It aims to measure and analyse various aspects such as waste management, water usage and carbon emissions to promote eco-friendly practices and sustainability initiatives.

REVIEW OF LITERATURE

Environmental audit work was taken up in sugar factory, kumbhi kasari sugar factory, Kolhapur (2011). To study the impact and interrelationship between nature and anthropogenic activities a case study was done on the theme Green audit and environmental sustainability in Nigeria (2013). Similarly in various places in India like Nagpur, Environmental audit in Indian coal industry was analysed (2015), in Ludhiana, Emerging paradigms in environmental audit GGN Khalsa college (2016), Environmental audit for environmental improvement and protection, Republic of Serbia (2017), Green audit-A holistic approach for sustainable development, Sambalpur, India (2018), Green audit in academic institutes, University of Mumbai, Maharashtra, India (2019), Environmental green accounting and auditing practice in Makassar state University of India (2019), Environmental audit contribution to the evaluation and control of environmental information in University of Targovishte (2020) and A green audit of the institution: A step towards environmental sustainability government degree college, Devarakonda, India (2023) the research and analysis were carried out.

OBJECTIVES

1. Land use analysis of JSS campus.
2. Floral and Faunal diversity of the college campus.
3. Physico-chemical analysis of Artificial water bodies of the campus.
4. Studies to find out the phytoplankton diversity and their distribution.
5. Environmental data of the college.

i. Noise level
ii. Weather data
iii. Soil properties
iv. Water analysis
v. Waste disposal of the college.
vi. Environmental awareness initiative

OBSERVATIONS

General overview of the concept of land use

Land use refers to man activities and the various uses which are carried on and derived from land. Viewing the earth from space, it is now very crucial in anthropogenic activities on natural resource. Therefore, attempt has been made in this study to map land use in JSS campus, Dharwad with, a view to detect the land consumption in built-up areas using both remote sensing and GIS techniques. Our campus spread over 44 acres 37 guntas 21.40 annas of land in the outskirt of Dharwad city.

Photo 1: Aerial view of J.S.S Campus

Table 1: Data of Land used in J.S.S campus

Categories of land	Area (in Sqm)
Total green cover (include roads)	64,688.32
Total built up area	68,019.69
Playgrounds	33,200
Parking area	16,200
Total campus area	1,82,107.91

Faunal and Floral diversity in JSS college campus

Considering the importance of biodiversity in our campus, a variety and variability of living organisms are encouraged to flourish. A wide range of genetic diversity and ecosystem are maintained systematically within the campus. The present report documents the local flora and fauna which is available in our JSS college campus. The survey carried out so far evidences the following fauna with inclusion of animals in different levels of food chain viz Annelida, Arthropoda, Pisces, Amphibia, Reptilia, Aves, and Mammalia. Some part of campus is covered with rich wild herbal flora which includes medicinal plants. A beautiful flower garden attracts a community of insects. Obviously, this dense green flora is associated with some local fauna mostly beautiful and colourful butterflies, beetles, bees, ants and caterpillars. Quite often varieties of migratory birds are landing in the campus and gives extra beautification to campus. On the other hand, varieties of birds like wood pecker, owls, sparrows, pigeons, parrots etc are regularly visiting the campus in search of food. Animals like monkeys, dogs, cats, rats, snails are usually seen. Diversity of frogs has been observed much in rainy seasons especially around small pond. Snakes are occasional visitors.

Table 2: Faunal diversity in the campus

PHYLUM/ CLASS	EXAMPLES	SCIENTIFIC NAMES
ARTHROPODA	Wasp	*Syntomoides imaon*
	Moths	*Macroglossum stellatarum, Antheraea paphia*
	Ants	*Componotus atriceps, Iridomyrmex purpureus, Tetraponera rufonigra, Manica rubida, Aphaenogaster*
	Butterflies	*Papilio polytes, Danaus chrysippus, Parantica aglea, Jezebe, Sara orangetip, Pachliopta hector, Phalaenoides, Junonia iphita, Ypthima huebneri,* Tiny grass blue
	Beetles	*Protaetia, Cicadas, Aspidimorpha royalty, Hyalomma, Madagascar beetle, Orange Blister beetle*
	Bugs	*Oncopeltus fasciatus*

	Insects	*Slender skimmer, Neurothemis tullia, Brachythemis contaminata, Damselfies, Rhyothemis variegata, Narrow winged damselfies, Tettigoniida*
	Honey Bee	*Apis dorsata, Xylocopa, Apis florae*
	Spider	*Carrhotus sannio, Menemerus bivittatus, Telamonia dimidiate, Oxytate virens, Oxyopus salticus*
	Mosquitoes	*Anopheles sinensis, Culex*
	Cockroach	*Periplaneta americana*
MOLLUSC	Apple snail	*Pomacea canaliculate*
	Slug	*Leidyula floridana*
	Thilapia	*Oreochromis niloticus*
PISCES	Western mosquito fish	*Gambussia affinis*
AMPHIBIA	Frogs	*Polypedates leucomystax, Duttaphrynus melanostictus, Microhyla ornate, Euphlyctis cynophlyctis*
REPTILIA	Garden lizard	*Calotes versicolor*
	House lizard	*Hemidactylus frenatus*
	Mabuya	*Eutropis carinata*
	Snakes	*Naja naja, Ahaetulla nasuta, Drymarchon melanurus*
AVES	Red-vented Bulbul	*Pycnonotuscafer*
	Greater coucal	*Centropus sinensis*
	White-throated Kingfisher	*Halcyon smyrnensis*
	Common tailor bird	*Orthotomussutorius*
	Oriental Magpie Robin	*Copsychussaularis*
	Tickell's Blue Flycatcher	*Cyornistickelliae*
	Ashy prinia	*Priniasocialis*
	Small minivet	*Pericrocotus Cinnamomum*
	Asian koal	*Eudynamysscolopaceus*
	White-throated fantail	*Rhipidura albicollis*
MAMMALIA	Mongoose	*Herpestes edwardsii*
	Monkeys	*Macaca mulatta*
	Langur	*Semnopithecus entellus*
	Squirrels	*Funambulus palmarum*
	Rats	*Rattus rattus*
	Domestic dogs	*Canis lupus familiaris*
	Cats	*Felis catus*

Physico-chemical analysis of pond water

Analysis of physico-chemical parameters of water is essential to assess the quality of water for the best usage like irrigation, bathing, fishing and industrial processing. Environmental pollution is modern day evil affecting all ecosystems. Therefore, the conservation of fresh water environment and its monitoring is highly essential.

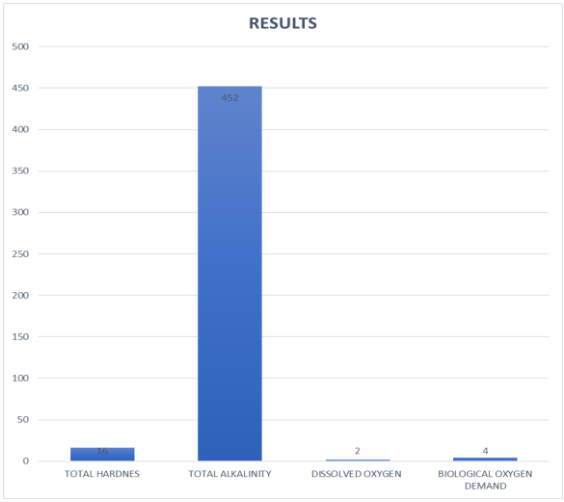
Parameters

- Estimation of Total hardness
- Estimation of Total alkalinity
- Estimation of Dissolved oxygen
- Estimation of biological oxygen demand

Table 3: Showing values of physico-chemical analysis of artificial water body of the campus.

PARAMETERS	RESULTS
pH	7.5
Air Temperature	25°C
Water Temperature	23°C
Total Hardness	16 mg/l
Total Alkalinity	452 mg/l
Dissolved Oxygen	2 mg/l
Biological Oxygen Demand	4 mg/l

Figure 1: Showing graphical representation of physico-chemical analysis of artificial water of the campus.



Phytoplankton diversity

The physical and chemical characteristics of water affect the abundance species composition, stability and productivity of the indigenous populations of the phytoplankton. The biological methods used for assessing water quality include collection, counting and identification of aquatic organism; and processing and interpretation of biological data.

Common Phytoplankton species in JSS campus pond:

1) *Peridinium cinctum* sps.
2) *Eudorina colony*
3) *Closterium* sps.
4) *Microcystis colonies*
5) *Cruciginea quadrata*
6) *Scenedesmus quadricauda*
7) *Staurastrum* sps.
8) *Dictyosphaerium* sps.
9) *Chlorella* sps.
10) *Nitzschinia*
11) *Chroococcus* sps.
12) *Aphanothece stagina*

Table 4: Floral Diversity in the JSS Campus:

Trees	Number
Acacia auriculiformis A. cunn. Ex Benth	219
Acacia catechu (Roxb.) Willd	2
Acacia chundru (Rottler) Willd	3
Acacia nilotica (L.) Delile	2
Aegle marmelos (L.) Corr.	8
Agathis Sp	1
Albizia lebbeck (L.) Benth.	5
Albizia odoratissima (Lf) Benth.	2
Albizia saman (Jacq.) Benth.	34
Alstonia scholaris (L.) R. Br	1
Anacardium occidentale	9
Annona reticulata L.	2
Annona squamosa L.	5
Artocarpus heterophyllus Lam.	12
Averrhoa bilimbi L.	2
Averrhoa carambola L.	1
Azadirachta indica Juss.	212
Balanites aegyptiaca (L.) Del.	15
Bauhinia purpurea L.	23
Bombax ceiba L.	1
Brownea coccinea Lacq.	2
Butea monosperma (Lam.) Taub	1
Callistemon citrinus (Curtis)	4
Caryota urens L.	1
Cascabela thevetia (L.) Lippold	18
Cassia fistula L.	5
Cassia javanica L.	5
Cassia spectabilis DC.	25
Casuarina equisetifolia L.	5
Ceiba pentandra (L.) Gaerin	1
Citharexylum spinosum L.	7
Citrus aurantifolia (Christon & Pauz) Swingle	9
Cocos nucifera L.	15
Corypha utan	2
Crescentia cujete	2
Dalbergia lanceolaria sp.	2
Dalbergia sissoo Roxb.	5
Dalbergia sissoides Grah. ex W. & A.	1
Delonix elata (L.) Gambl.	5
Delonix regia (Hook) Raf.	101
Dichrostachys cinerea (L.) W. & A	2
Erinocarpus nimmonii Grah. Ex Dalz.	2
Erythrina suberosa Roxb.	2
Eucalyptus tereticornis Sm.	501
Ficus amplissima J. E. Smith	8

Ficus bengalensis Planch	11
Ficus drupacea Thunb.	1
Ficus krishnae	1
Ficus religiosa	12
Garcinia xanthochymus	1
Gardenia latifolia Soland	1
Glyricidia sepium (Jacq.) Kunth.	9
Gmelina arborea Roxb.	1
Grevillea robusta A. Cunn. ex	2
Guazuma ulmifolia Lam.	1
Handroanth simpetiginosus (Mart. ex DC.) Mattos	1
Holarrhena pubescens (Buch. Ham.) Wall	1
Holoptelea integrifolia (Roxb.)	5
Jacaranda acutifolia Humb.	2
Kydia calycina Roxb.	5
Lagerstroemia speciosa (L.) Pers.	5
Limonia acidissima L	4
Magnolia alba (DC.) Figla	2
Magnolia champaca (L.) Baill. Ex Pierre	15
Madhuca longifolia (Koen.) Mac. Bride var. latifolia	2
Mallingtonia hortensis L.f	1
Malpighia glabra L	2
Mangifera indica L	23
Manihot glaziovii Muell.	1
Manilkara hexandra (Roxb.) Dubard	2
Manilkara zapota (L.) P. Royen	5
Markhamia lutea (Benth.) K. Schum	5
Melia azedarach L.	53
Morus alba L	3
Moringa oleifera Lam.	3
Mutingia calabura L	55
Neolamarckia cadamba (Roxb.) Bosser	1
Nyctanthes arbor-tristis L	3
Peltophorum pterocarpum (DC.) Back Ex. K. Heyne	15
Persea americana Miller	1
Phyllanthus acidus (L.) Skeels	2
Phyllanthus emblica L.	6
Pimenta dioica (L.) Merr.	1
Pinus roxburghii	2
Pithecellobium dulce (Roxb.) Benth	103
Plumeria obtusa L Skeels	3
Podocarpus sp.	2
Polyalthia longifolia B. & H.	70
Pongamia pinnata (L.) Pierre	101
Prosopis juliflora (Sw.) DC.	15
Psidium guajaya L	37
Punica granatum L	10
Ravenala madagascariensis J.F. Gmel	2
Roystonea regia (H.B.K.) O.F. Cook	1
Santalum album L.	456
Sapindus laurifolius Vahl	4
Saraca asoca (Roxb.) Willd	9
Sesbania grandiflora (2)	2
Simarouba glauca DC.	2
Spathodea campanulata P. Beauv	104
Streblus asper Lour.	1
Swietenia macrophylla King.	5
Syagrus romanzoffiana (Cham.) Glassman	1
Syzygium cumini (L.) Skeels	7
Syzygium samarangense (Bl.) Merr. & Perry	2
Tabebuia aurea (Silva Manso) B. & H.f. ex S. S. Moore	1
Tabebuia rosea	1
Tamarindus indica L.	33
Tectona grandis	11
Terminalia bellirica (Gaertn.) Roxb	1
Terminalia catappa	44
Terminalia elliptica	1
Terminalia paniculata Roth.	1
Thespesia populnea (L.) Soland	12
Thuja orientalis	6
Toona ciliata M. Roem.	1
Trema orientalis (L.) Bl	2
Ziziphus mauritiana Lam	15
Total number of trees in the campus	2622

Environmental Audit

1. Noise level of the campus

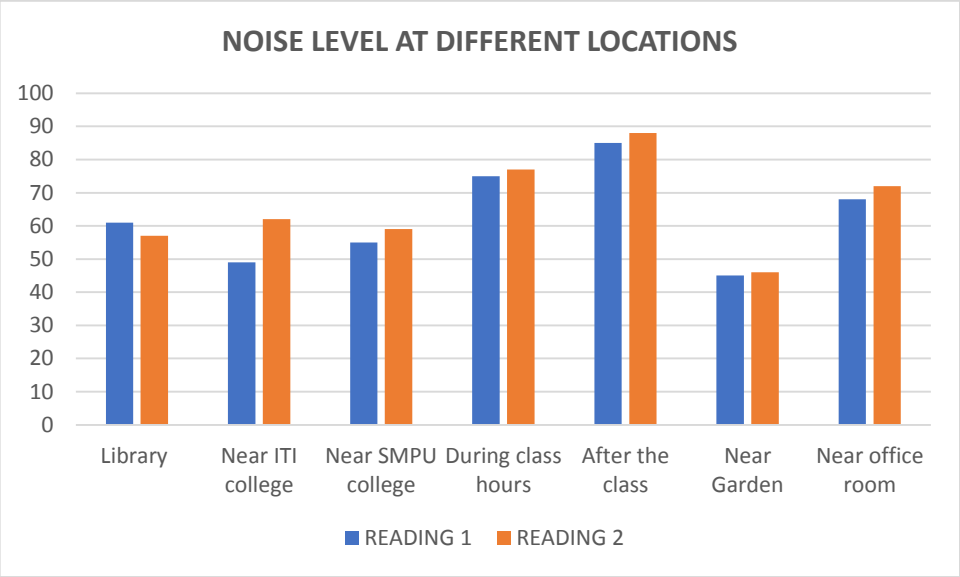
Under the Air Act 1981, noise is considered as a pollutant. Noise is mostly occurred in two major situations community noise and industrial noise. The noise level monitoring was carried out to assess the equivalent noise level within the JSS college campus. The test was carried out in each location and maximum, minimum and average noise level reading were recorded. The noise monitoring was carried out at the different locations within the campus.

Table 5: Showing measured noise level in the college campus

LOCATION	READING 1	READING 2
Library	61	57

Near ITI college	49	62
Near SMPU college	55	59
During class hours	75	77
After the class	85	88
Near Garden	45	46
Near office room	68	72

Figure 2: Showing graphical representation of noise level in the college campus



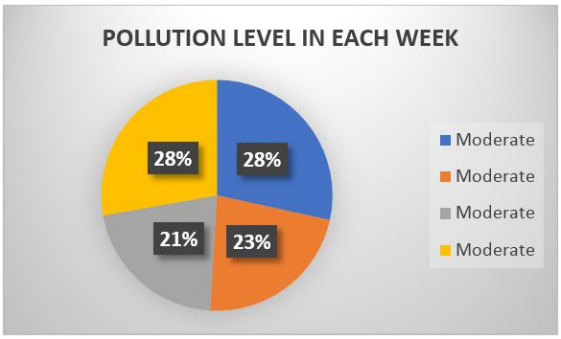
2. Weather data

The ambient air temperature, relative humidity, wind and pressure data were obtained from the IQ Air website. Its parameters are compared on a daily average basis. The model considers the effect of cloud cover and local atmospheric conditions. The table shows the average air temperature, humidity, wind and pressure of the JSS college campus.

Table 6: Showing the weakly weather data of the campus

DATE	AIR POLLUTION	LEVEL
07/05/2024	Moderate	91
12/05/2024	Moderate	72
14/06/2024	Moderate	68
29/06/2024	Moderate	89

Figure 3: Showing graphical representation of weather data of the college campus



Note: 0-50% air quality excellent (AQI)

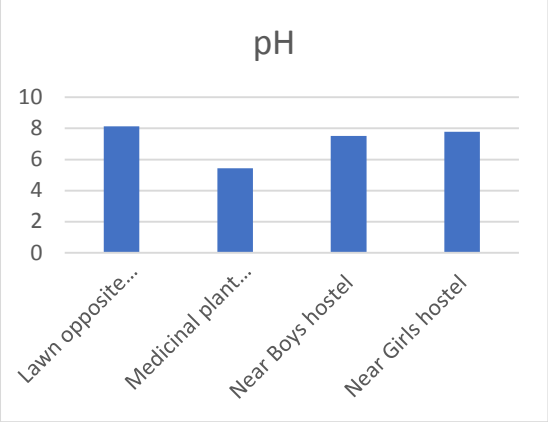
3. Soil properties

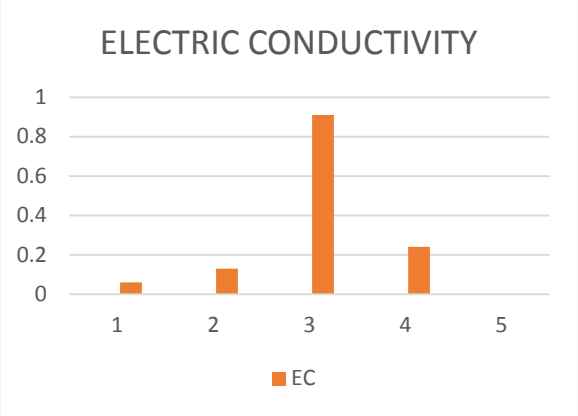
The soil quality inside the campus of JSS college was tested by the office of ICAR-Krishi Vigyan kendra, Saidapur farm, Dharwad. Parameters like pH, EC, Nitrogen, Organic Carbon, Phosphorus, Potash were tested.

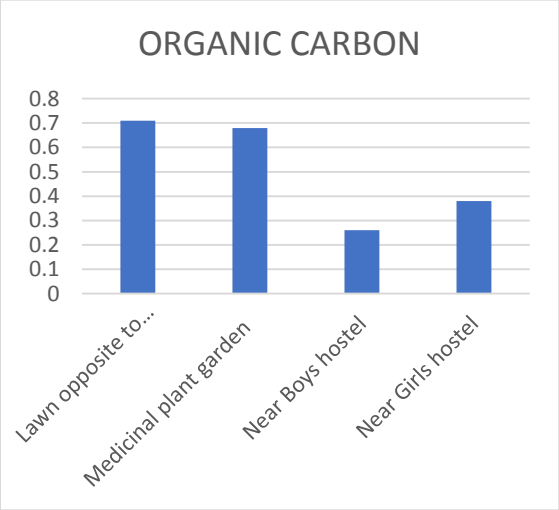
Table 7: Showing the soil properties level of the college campus

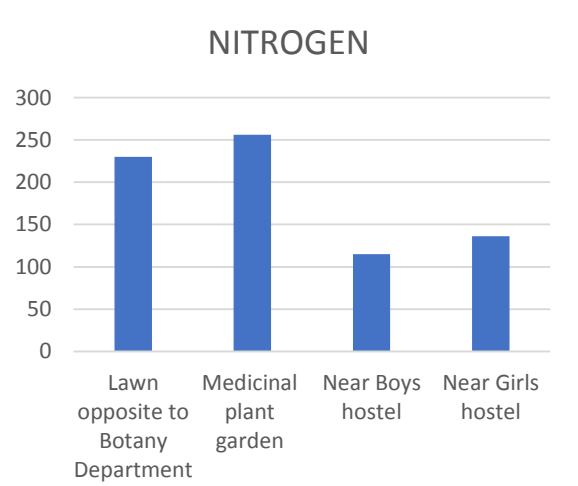
Soil sample	pH	EC	Organic carbon	Nitrogen	Phosphorus	Potassium
Lawn opposite to Botany Department	8.14	0.06	0.71	230	9	196
Medicinal plant garden	5.44	0.13	0.68	256	11	225
Near Boys hostel	7.51	0.91	0.26	115	8	136
Near Girls hostel	7.79	0.24	0.38	136	9	112

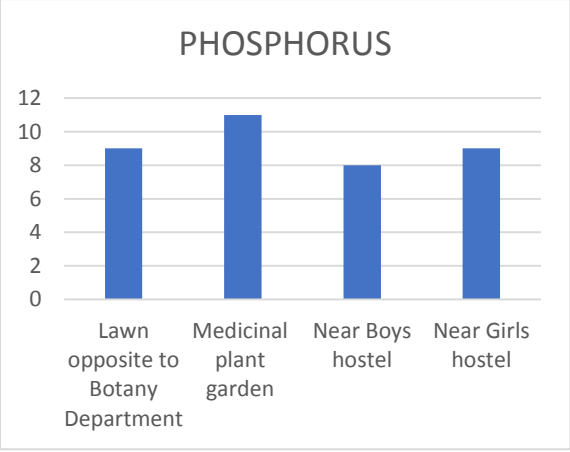
Figure 4: Showing graphical representation of soil properties of the college campus

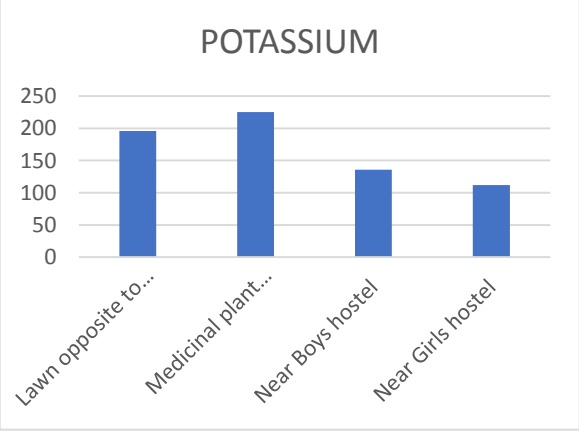












4. Water analysis

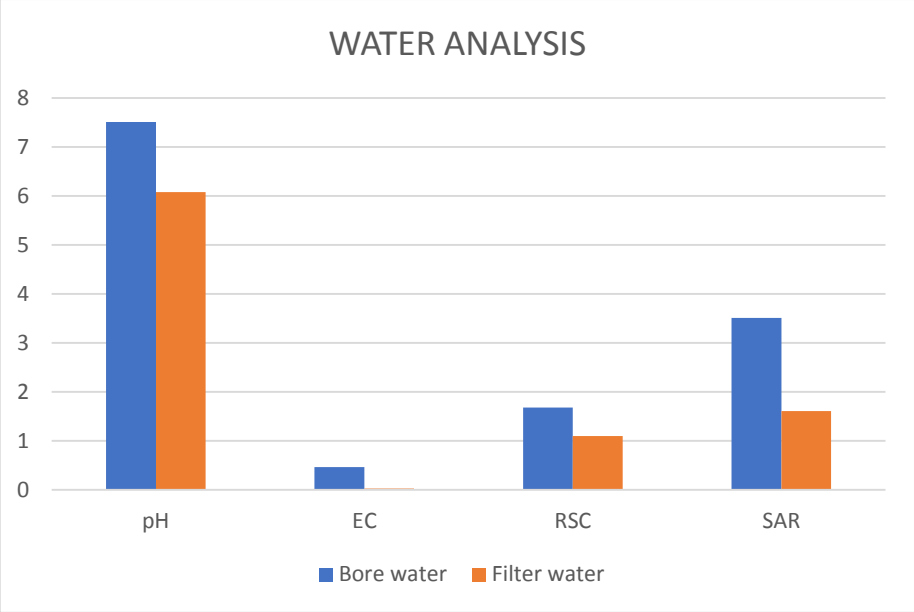
Water quality testing is an important task of green audit as it identifies contaminants and avoids water borne diseases. Water quality test has been conducted by ICAR-Krishi Vigyan kendra, Saidapur farm, Dharwad. The values of various parameters of the water sample tested are within WHO permissible limit. The list of indicators often measured to identify the quality: pH value, Electrical conductivity (EC), Residual Sodium Carbonate (RSC), Sodium absorption ratio (SAR).

Table 8: Water quality testing report of Bore water and Filter water

WATER SAMPLE	pH	EC	RSC	SAR
Bore water	7.51	0.47	1.67	3.51

Filter water	6.08	0.03	1.1	1.61

Figure 5: Showing graphical representation of water quality testing report



Waste disposal and management

'Plastic Free Zone Campaign' conducted has brought down the usage of disposable plastic goods to the minimum. Eradication of parthenium plant is a regular activity of NSS and NCC to tackle hazards in and out of the college.

Waste management systems:

Solid waste management system

Both biodegradable as well as non-biodegradable waste are generated from various departments of the college. It includes paper, plastic, glasses, electronic wastes, canteen waste and other solid wastes.

i. Biodegradable – Leaf litter and canteen plate wastes are used to make vermicompost and organic manure. Both are used to nurture campus garden plants.
ii. Non-biodegradables – These are well managed, collected and carried everyday by municipal corporation vehicle.
iii. E-Waste Management

JSS management follows suitable measures to dispose E-Wastes generated from various sources. E-Wastes generated from computer laboratories, academic and administrative offices. The E-waste includes laboratory instruments, electronic circuits, computer desktops, laptops, accessories and printers etc. Unused computers in good condition are donated to schools for basic study purpose. All these wastes which cannot be reused or recycled are being disposed through authorised vendors. UPS and batteries are recharged/repaired/exchanged by suppliers. E-Waste is sold as scrap to private agency for recycling.

Environmental awareness initiative

The college students and staff are aware of the various environmental issues and the various green measures are adopted. Various awareness programmes are conducted regularly in this regard.

Green campus initiative:

The management commits to enrich healthy habitat and maintaining the symbiotic relationship of the institution with nature by

- Organizing annual tree plantation drives
- Encouraging students of NCC and NSS in tree-planting events on various occasions.
- Poster free campus
- Maintenance of medicinal plant garden
- Maintenance of beautiful Lawns
- Landscaping with diversity of Angiospermic trees, herbs, shrubs, Pteridophytes and Gymnosperms.

The campus landscape is a vital part of a campus, providing space for study, play grounds for outdoor events, well equipped GYM, facilities for Indoor games, health care centre, bank, post, canteens, wash

rooms, resting rooms for relaxation and aesthetic appreciation. Green campus landscape aims to manage runoff (Rain Water Harvesting unit) that helps to recharge groundwater and cool the air (clean) within the campus. Solar panels and solar lights are installed to save electricity. Sewage water from various buildings is collected, recycled (treatment tanks) and used to water the campus plants.

DISCUSSION

Garden soil of JSS college campus is alkaline which may require adjustments. Soil amendments like sulphur or organic matter can be added. Medicinal plant garden soil is closer to the neutral range and more suitable for a wider range/variety of plants.

Bore water sources of campus slightly alkaline and very close to neutral. pH values indicate that the water is likely to be safe for drinking and irrigation. Overall, both water samples are good and suitable for a wide range of applications.

Noise level has quieter and more conducive environment for administrative tasks. The higher noise level at campus might require noise control measures to improve comfort and productivity

CONCLUSION

The green audit assists in the process of testing performance in the environmental arena and is fast and an indispensable aid to decision making in the campus. The green audit reports assist in the process of attaining an eco-friendly approach to the sustainable development of the campus. Hope that the results presented in the green audit report will serve as a guide for educating the campus community on the existing environment related practices and resource usage at the college as well as spawn new activities and innovative practices. A few recommendations are added to curb the menace of waste management using eco-friendly and scientific techniques. This may lead to the prosperous future in context of green campus and thus sustainable environment and community development.

ACKNOWLEDGEMENT

Green audit assessment team acknowledge the Karnataka university, Dharwad for introducing project work in last semester of our academic curriculum. Our special thanks to Secretary, Dr. Ajith Prasad, JSS Institutions, Development officer Dr. Suraj Jain, Principal Dr. Nagachandra and HOD of Botany Dr. V. S. Bheemareddy, for their great support and encouragement throughout the process. We are thankful to Dr. Ratna Airsang, who played a crucial role in executing the “Green Audit” of the campus. She has coordinated the entire process and was mainly responsible for this entire project. A special thanks to Dr. R. Parimala and Harshvardhan Jamakhandi.

REFERENCES

[1] The Environmental audit of sugar factory: Kolhapur. Volume 1 in (2011) pp 51-57.
[2] Green Audit and Environmental sustainability in Nigeria. Volume 2, Number 1 in October (2013). ISSN: pp 2350-2231(Online) ISSN: 2346-7215 (Print).
[3] Environmental Audit in Indian Coal Industry Nagpur. India. Vol 1 (1), Print ISSN: 2395-1990 Online ISSN: pp 2349-4099 in (2015).
[4] Emerging Paradigms in Environmental Audit, GGN Khalsa college, Ludhiana. Volume 3, Issue 4, ISSN:pp 2349-705X IN APRIL (2016).
[5] Environmental Audit for Environmental Improvement and Protection, Republic of Serbia. 55(4): pp 521-538 in (2017).
[6] Green audit – A Holistic Approach for Sustainable Development, Sambalpur, India. 34(2) pp 2115-2124 in (2018).
[7] Green Audit in Academic Institutes, University of Mumbai, Maharashtra, India. Volume 8, Issue 8(6), ISSN: 2277-7881, Impact factor-6.014; IC value: 5.16; ISI value: 2.286 (2018).
[8] Environmental Green Accounting and Auditing Practice in Makassar university of Indonesia. Volume 10, No.8, Paper ISSN: 2222-1697, Online ISSN: 2222-2847 in (2019).
[9] Environmental Audit Contribution to the Evaluation and Control of Environmental Information, University of Targoviste. ISSN: 2601-2501, e-ISSN: 2601-2529 pp 200-213 in (2020).
[10] A Green Audit of the institution: A step towards Environmental sustainability: MKR Government Degree College, Devarakonda, India. 15(6); 592-598 (2023) ISSN No (Print) pp 975-1130 ISSN No (Online)2249-3239.
[11] A flowering trees of JSS College Campus, Dharwad: Dr. R.Parimala, 2014.