GREEN AND ENERGY AUDIT, A TOOL FOR ENVIRONMENTAL PROTECTION AND CONSERVATION

The modernization and industrialization are the two important outputs of twentieth century which have made human life more luxurious and comfortable. Simultaneously, they are responsible for voracious use of natural resources, exploitation of forests and wildlife, producing massive solid waste, polluting the scarce and sacred water resources and finally making our mother Earth ugly and inhospitable. Today, people are getting more familiar to the global issues like global warming, greenhouse effect, ozone depletion and climate change etc. Now, it is considered as a final call by mother Earth to walk on the path of sustainable development. The time has come to wake up, unite and combat together for sustainable environment.

Considering the present environmental problems of pollution and excess use of natural resources, Hon. Prime Minister, Shri. Narendra Modiji has declared the Mission of Swachch Bharat Abhiyan. Also, University Grants Commission has mentioned "Green Campus, Clean Campus" mission mandatory for all higher educational institutes. As environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to environmental sustainability is more prevalent.

Green Audit is the most efficient ecological tool to solve such environmental problems. It is a process of regular identification, quantification, documenting, reporting and monitoring of environmentally important components in a specified area. Through this process the regular environmental activities are monitored within and outside of the concerned sites which have direct and indirect impact on surroundings. Green audit can be one of the initiative for such institutes to account their energy, water resource use as well as wastewater, solid waste, E-waste, hazardous waste generation. Green Audit process can play an important role in promotion of environmental awareness and sensitization about resource use. It can create consciousness towards ecological values and ethics. Through green audit one can get direction about how to improve the condition of environment.

Need of Green auditing:

Green auditing is the process of identifying and determining whether institutions practices are eco-friendly and sustainable. Traditionally, we are good and efficient users of natural resources. But over the period of time excess use of resources like energy, water, chemicals are become habitual for everyone especially, in common areas. Now, it is necessary to check whether our processes are consuming more than required resources? Whether we are handling waste carefully? Green audit regulates all such practices and gives an efficient way of natural resource utilization. In the era of climate change and resource depletion it is necessary to verify the processes and convert it into green and clean one.Green audit provides an approach for it. It also increases overall consciousness among the people working in institution towards an environment.

Goals of Green audit:

University has conducted a green audit with specific goals as:

- Identification and documentation of green practices followed by university.
- Identify strength and weakness in green practices.
- Conduct a survey to know the ground reality about green practices.
- Analyze and suggest solution for problems identified from survey.
- Assess facility of different types of waste management.
- Increase environmental awareness throughout campus.
- Identify and assess environmental risk.
- Motivates staff for optimized sustainable use of available resources.
- The long-term goal of the environmental audit program is to collect baseline data of environmental parameters and resolve environmental issue before they become problem.

Students are the major strength of any academic institution. Practicing green actions in any educational institution will inculcate the good habit of caring natural resources in students. Many environmental activities like plantation and nurturing saplings and trees, Cleanliness drives, Rain water harvesting, etc. will make the students good citizen of the country. Through Green Audit, higher educational institutions can ensure that they contribute towards the reduction of Global warming through Carbon Footprint reduction measures.

Benefits of Green Audit to an Educational Institute:

There are many advantages of green audit to an Educational Institute:

- It would help to protect the environment in and around the campus.
- Recognize the cost saving methods through waste minimization and energy conservation.
- Find out the prevailing and forthcoming complications.
- Empower the organization to frame a better environmental performance.
- It portrays good image of institution through its clean and green campus.

Sri Venkateswara University, Tirupati, Andhra Pradesh at a Glance:

Sri Venkateswara University established in 1954, to cater to the educational needs and aspirations of people of Rayalaseema Region of Andhra Pradesh. After completing 68 years of excellence in teaching, research, extension and outreach activities, the University is committed to cater to the needs of higher education offering a full range of post-graduate programs in Arts, Sciences, Law, Management, Education, Physical Education, Engineering and Pharmacy disciplines. From a humble beginning of one College with six departments, the University has now grown into the second largest University in Andhra Pradesh having four

constituent Colleges viz. College of Arts, College of Sciences, College of Commerce, Management & Computer Science and College of Engineering accommodating 54 departments offering 88 programs.

The University has made rapid strides in the field of higher education and research and is adjudged as one of the best Universities in the country and got **ACCREDITED A+**

GRADE BY NAAC-2017.

Various prestigious rankings and Academic credits in the year 2019-2020.

QS India Rankings-2020	: 44
NIRF University category	: 38
THE Young University Rankings-2020	: 101-150
Education world Rankings 2020	: 23
THE world University Rankings-2021	:801-1000
Citations(Normalized) for 2014-2019	:16.321
PhDs awarded	: 217 FT + 129 PT
Patents filed	: 3
Total research projects on going	: 34
Total amount	: Rs.53.14,94,271
Consultancy projects	: 629
Money generated through consultancy	: Rs. 766965/-

The University is selected under RUSA component 4 for Rs.100 crore. Under this program Centres of Excellence in (i)Nano & Micro Satellite (ii) Earth & Atmospheric Sciences (iii)Material Sciences (iv)VLP Technologies (v) Herbal Drug Development (vi) Psycho & Bio Sciences (viii) Water Resources and (ix) Bio Energy. University is having National facilities (UGC-SVU centre for MST Radar Applications) of repute and selected under Centre for Potential of Excellence in a particular area(CPEPA) by UGC, New Delhi and awarded and with Centres for Advanced Study (UGC-CAS). University was awarded based on research output DST-PURSE program.

Several departments have received Special Assistance Programmes (SAP) of UGC, New Delhi and also received fund under FIST program of DST, New Delhi to improve infrastructural facilities. Most of the faculties have obtained research grants from various national funding agencies like UGC, DST, DBT, CSIR, ICMR, ICSSR, BRNS, ISRO, MNES, MoES, MoEF and DRDO and foreign financing such as UNESCO, UK-DFID, ICRISAT, European Commission Programme ERASMUS MUNDUS. Utilizing these impressive funding, the faculty of the University have proactively interacted with Industry, Academic and Research Institutes in National and International level and entered into collaborative research agreements through MoUs (Memorandum of Understating) to conduct research work in frontier areas of national & International importance.

The students belonging to socially and economically backward communities and those who are economically poor get State and Central Government Welfare Scholarships. Fellowships and Scholarships are offered to research students of the campus by the University and also by the UGC, CSIR, DAE, ICMR, ISRO, ICAR, ICPR, ICHR, ICSSR, DST, DRDO, SRNS and Rashtriya Sanskrit Sansthan.

The University central library is the major resource centre that provides information for research students and faculty. It provides unlimited access to the UGC INFONET e-resources and e-journals through UGC INFONET Digital Library Consortium. The library is kept open from 8.00 am till 10.00 pm on all working days and from 10.00 am to 5.00 pm on Sundays and public holidays besides the addition of latest books related to both teaching and research in the main library, most of the departments have developed departmental libraries by utilizing the grant from the University or from special assistance received from funding agencies like UGC, DST, etc. A Digital Library for PhD Theses submitted to the University has been designed using DSpace, an Open Source Software developed by HP and MIT, USA. 3,000 PhD Theses have been digitalized and uploaded to the Shodhganga database. This gives easy access to the PhD theses and research documents.

The University provides residential facilities to research scholars, Post-Doctoral fellows and other researchers in the hostels specially earmarked for them on the campus. Summer fellows, research associates, visiting scientists and faculty researchers from other universities and academics are provided accommodation in the university guest house and Academic Staf college guest house. The university campus is completely Wi-fi connected. The university provides computer and uninterrupted internet facilities for research students, fellows as well as faculty on the campus in all the blocks and laboratories. Direct internet facility and common internet hubs are set-ups near the hostels and quarters on the campus to provide internet access free of cost.

To further enhance the status of the University to compete with the top University at National and Global level through continued development during 2019-2020, additional Buildings for E-Class Rooms, Establishment of Incubation Centres, On-line Examination System/expansion of Laboratories to meet the requirements of new Courses are in the pipeline. Besides meeting the infrastructure facilities of office, Separate Hostels for Boys and Girls, Cultural Centre and world Class Gymnasium and Sports facilities are being created. International Students Canteen, Digital Library, Wi-Fi Connectivity, Networking, Smart Campus, Air-Conditioned Auditorium, Development of Greenery and State of the modern art furniture in classrooms, faculty rooms, offices, Guest House and Auditorium are under progress.

Sri Venkateswara University Map

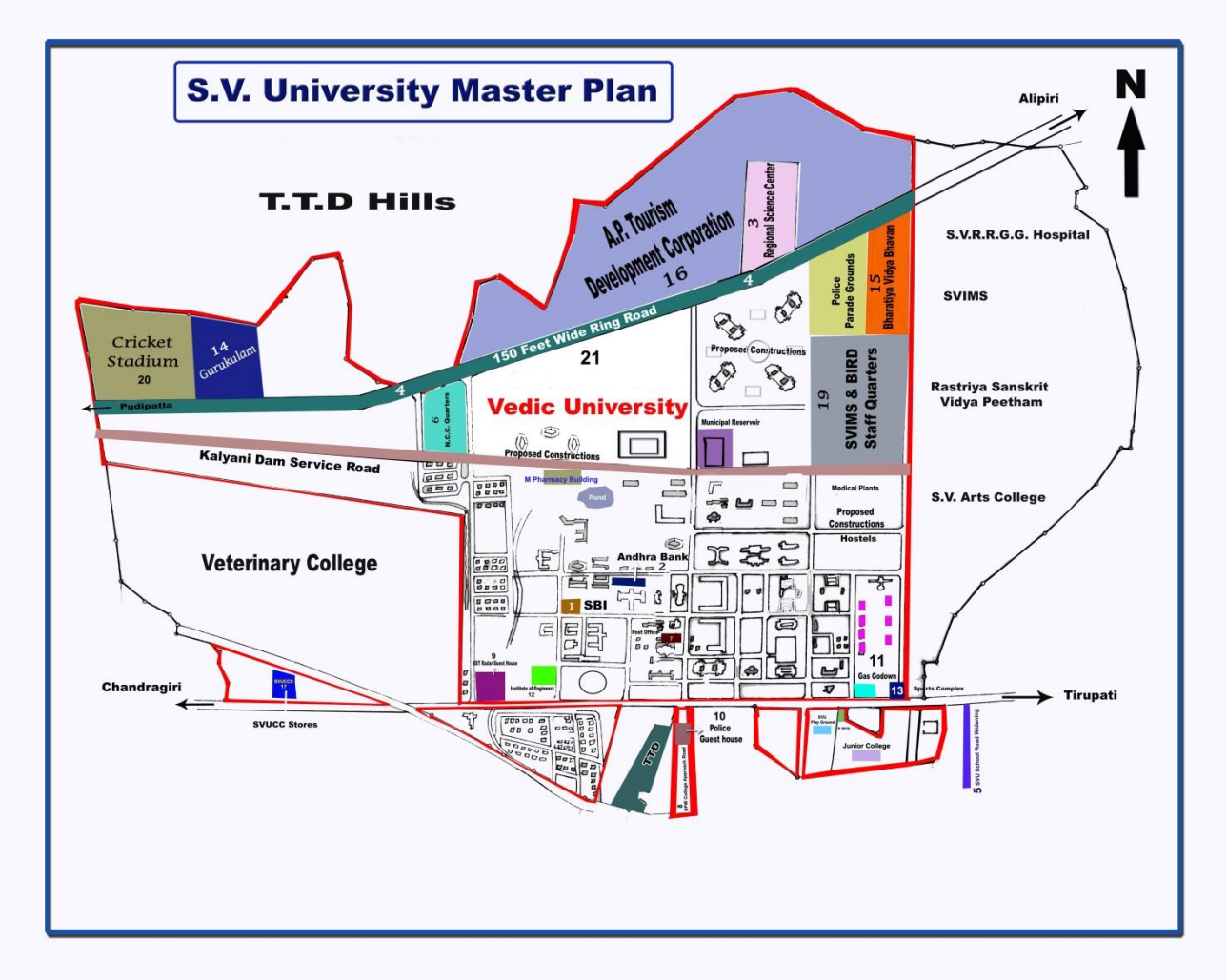


Fig .1: Sri Venkateswara University Master Plan

Objectives of Green audit:

The main objective of Green Audit at **Sri Venkateswara University** is to make a complete assessment of the environmental indicators in the campus and make recommendations for implementation in the campus for better environmental management. To make a complete assessment of the environmental indicators in the campus and make recommendations for implementation in the campus for better environmental management.

1. To assess the quality of the water and recycling of waste water in the university campus
2. Estimation of energy & fuel usage and evaluating the carbon foot print of the university on a full attendance day
3. Evaluation of the measures implemented by university in reducing the Carbon Footprint
4. To monitor the generation of solid waste and adopting strategies for its recycling

5. To evaluate the biodiversity of flora and fauna of the campus and providing a database for corrective actions and future plans.

Water and Wastewater Audit

Water which is precious natural national resource available with fixed quantum. The availability of water is decreasing due to increasing population of nation, as per capita availability of utilizable water is going down. Due to ever rising standard of living of people, industrialization, urbanization, demand of fresh water is increasing day by day. The unabated discharge of industrial effluent in the available water bodies is reducing the quality of these ample sources of water continuously. Hence, the national mission on water conservation was declared by the then Hon. Prime Minister Narendra Modi as 'Jal Shakti Abhiyan' and appealed to all citizens to collectively address the problem of water shortage, by conserving every drop of water and suggested for conducting water audit for all sectors of water use.

Water audit can be defined as a qualitative and quantitative analysis of water consumption to identify means of reducing, reusing and recycling of water. Water Audit is nothing but an effective measure for minimizing losses, optimizing various uses and thus, enabling considerable conservation of water in irrigation sector, domestic, power and industrial as well. A water audit is a technique or method which makes possible to identify ways of conserving water by determining any inefficiencies in the system of water distribution. The measurement of water losses due to different uses in the system or any utility is essential to implement water conservation measures in such an establishment.

Importance of Water audit

It is observed that a number of factors like climate, culture, food habits, work and working conditions, level and type of development, and physiology to determine the requirement of water. The community which has a population between 20,000 to 1,00,000 requires 100 to 150 liters per person (capita) per day. The communities with a population can consume over 1, 00,000 requires 150 to 200 liters per person (capita) per day. As per the standards provided by WHO Regional office for South East Asia Schools require 2 liters per student; 10-15 liters per student if water-flushed toilets.

. Water usage can be defined as water used for all activities which are carried out on campus from different water sources. This includes usage in all residential halls, academic buildings, on campus and on grounds. Wastewater is referred as the water which is transported off the campus. The wastewater includes sewage, hostel and residential water used in cooking, showering, clothes washing as well as waste water from chemical and biological laboratories which ultimately going down in sink or drainage system.

University water resources

The Main water uses in the campus includes drinking, cleaning, toilets and gardening. The University campus has continuous water supply of 24/7 through AP Government Telugu

Ganga project. In addition there are 10 numbers of water bore wells in Men and Women Hostels, Engineering college campus and university gardens. The campus has several water harvesting units to recharge ground water. The water requirement is calculated based on per person utility per day. Toilet usage -20 lts, Shower -20 lts, clothes washing- 20 lts, utensil washing – 10 lts, mopping and washing rooms– 10 lts, cooking – 5 litres, drinking -2.5 lts and gardening – 30 lts.

Fig. 2:Bore well

Fig. 3: Open well

Rain Water Harvesting

Rainwater harvesting means capturing rain where it falls or capturing the run off of rain water in Sri Venkateswara University premises. Rainwater harvesting system, also called rainwater collection system or rainwater catchment system, technology that collects and stores

rainwater for further use. The collected water is also kept clean by filtering and such design of facility that does not allow pollutants to mix with collected water. Rain water is harvested from terrace, and ground floor areas for reusing in watering of lawns. Surface runoff from various ground sources and terraces are collected, filtered and recirculated for gardening and washing purpose. Besides natural percolation tanks, concrete storage tanks have also been built and rain water has been stored after proper filtration paving the open places with concrete roads is avoided so that rain water can be percolated. The rainwater harvested during rains not only helps to save water from conventional sources, but also to save energy and reduce expenses incurred on transportation and distribution of water. Awareness programmes on water conservation and rain water harvesting have been conducted regularly through various service of the University. One of the rain water harvesting pit is seen near Post Office. Similar structures are seen at different locations within premises.

Fig 4: Rain water Harvestng Pit

Fig. 5: Rain Water Harvesting

Fig. 6a.: Rain Water Harvesting at Academic Building

Fig. 6b.: Rain Water Harvesting at Academic Building

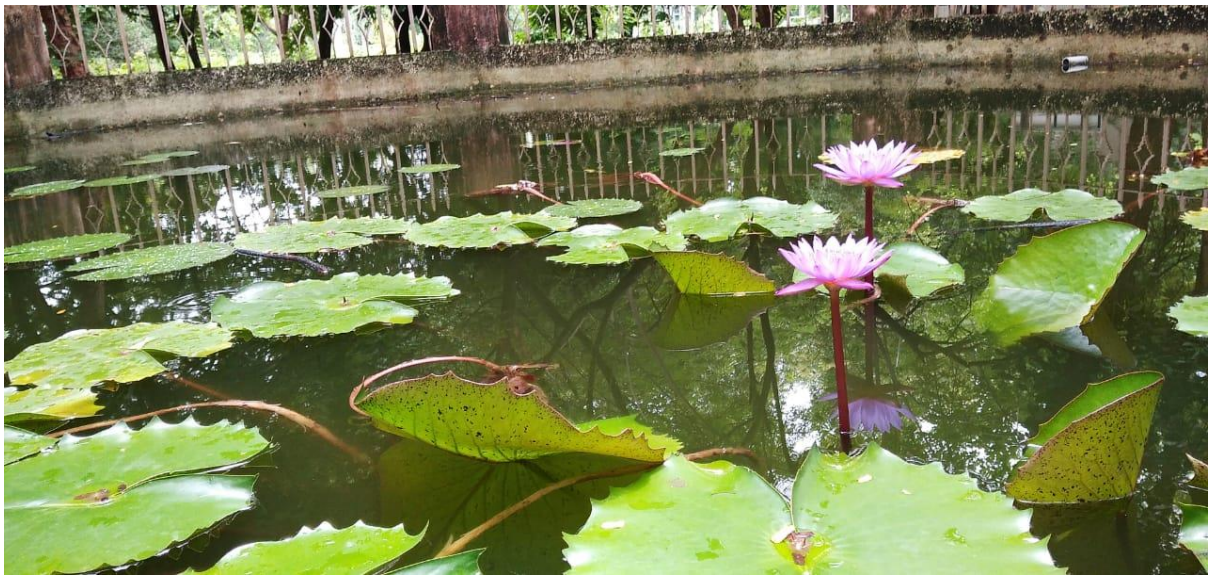


Fig. 6c.: Rain Water Harvesting at Academic Building

Reusage of waste water:

Wastewater recycling is considered as the best option of water usage. The waste water generated is filtered through coarse filter system and is used for watering outdoor lawns, gardens, potted plants, cleaning of stair case, verandas, pavements and drive ways.

Fig. 7.: Reusage of Waste water

Energy Audit:

Energy is one of the major inputs for the economic development of any country. The fundamental goal of energy management is to produce goods and provide services with the least cost and least environmental effect. Also it can be said as “the strategy of adjusting and optimizing energy, using system and procedure so as to reduce energy requirements per unit of output while holding constant or reducing total costs of producing the output from these systems”. The energy audit is key to a systematic approach for decision making in the area of energy management. It attempt to balance the total energy inputs with its use, and serve to identify all the energy streams in a facility.

According to Energy Conservation Act, 2001, Energy Audit is the verification, monitoring, and analysis of the use of energy including submission of a technical report containing recommendations for improving energy efficiency with cost-benefit analysis and an action planto reduce energy consumption.

Energy resources utilized by all the departments, support services and the administrative buildings of Sri Venkateswara University, Tirupati, Andhra Pradesh campus include electricity and liquid petroleum. Major use of the energy is at office, canteen, hostel and laboratories, for lighting, transportation, cooking and workshop instruments. Sri Venkateswara University has installed solar power plant having a capacity of 1.75 MW. Electricity is also supplied to the University campus by Andhra Pradesh Southern power Distribution Company Limited (APSPDCL).

Fig 8: Solar Panel at SVU Administrative Building

Fig. 9 Solar Panel at SVU Library **Fig 10 ：Solar Panel at Prakasam Bhavan**

Fig. 11: Solar Panel at Engineering College **Fig. 12: Solar Panel at SVU Hostels**

In Academics and Research, Solar dryer facility is available in the Department of Home Science. Food technology students and scholars conducted research projects using solar dehydration technology. Drying foods using solar energy helps in retaining the colour, Flavour and nutritional value to a large extent. It can minimize cost, wastage and increase the productivity in terms of quality and quantity. Hands on training was given to the students with the resource persons on solar dehydration. Various foods and food products were developed. The students undergone training programmes and internship in Society for Energy, Environment and Development (SEED) Hyderabad.

Solar dryers require a certain investment for the set-up of the appliance, but no expenditures for the fuel. The basic function of a solar dryer is to heat air to a constant temperature with solar energy, which facilitates extraction of humidity from foods inside a drying chamber. Ventilation is enabled at a constant rate through defined air inlets and outlets, small solar ventilators or temperature difference, either due to exposition or vertical height. In direct sun driers the food is put in boxes with a transparent lid. Additionally, the temperature in the drier is raised due to the greenhouse effect and the air exchange is regulated by vents. The food is not exposed to direct sunlight in indirect sun driers as the fresh air is heated separately from the food chamber. This method is preferable for drying

foods which lose nutritional value when exposed to direct sunlight. Hybrid driers combine solar energy with a fossil fuel or biomass fuel. Solar drying has many advantages over open traditional drying like; Safe & hygienic, Free from insect and bird contamination, Clean &dust free products, more uniform quality products, Uniform color, texture, and appearance of the product, evenness in drying, moisture control to optimum levels, Nutrient retention especially beta carotene, yields high quality Products with better shelf life of the products.

Fig. 13: Solar Drying Facility in the Department of Home Science

Fig. 14: Solar Drying by the students of Food Technology

Solar energy generated by solar panels are exported to the grid of electricity distribution utility of Southern Power distribution company of Andhra Pradesh Ltd. Direct savings in electricity bills are availed from electricity distribution utility on monthly basis. Workshops on 'Green Power Technology in Power Grid: Issues, Challenges and Control'' was taken place in the university.

Fig. 15: "Green Power Technology in Power Grid: Issues, Challenges and Control''

The Energy and electricity audit aimed to cover the aggregate consumption of Electrical and Natural gas energy within the Sri Venkateswara University campus including academic and administrative blocks. In different hostels, LPG cylinders are primarily used for cooking purposes and the number of uses was also counted. Domestic LPG connections were not included in the present study. Within the campus, no other fossil fuel like coal-fire or firewood,etc based energy is used.

All the buildings of the University are designed and constructed in such a way that during daytime no electricity is consumed for lighting of tube lights and other electric lights. Proper day light and ventilation facilities are available for every building.

Fig. 16: ISO 50001 : 2918 Certificate for Implementation of Energy Saving Practices

Fossil fuels (such as petrol, diesel) contribute significantly to environmental pollution through emission of greenhouse gases into the atmosphere mainly as carbon dioxide. Vehicular emissionis the main source of carbon emission in the campus, hence to document the various means of transportation that is practiced by the university members is important.

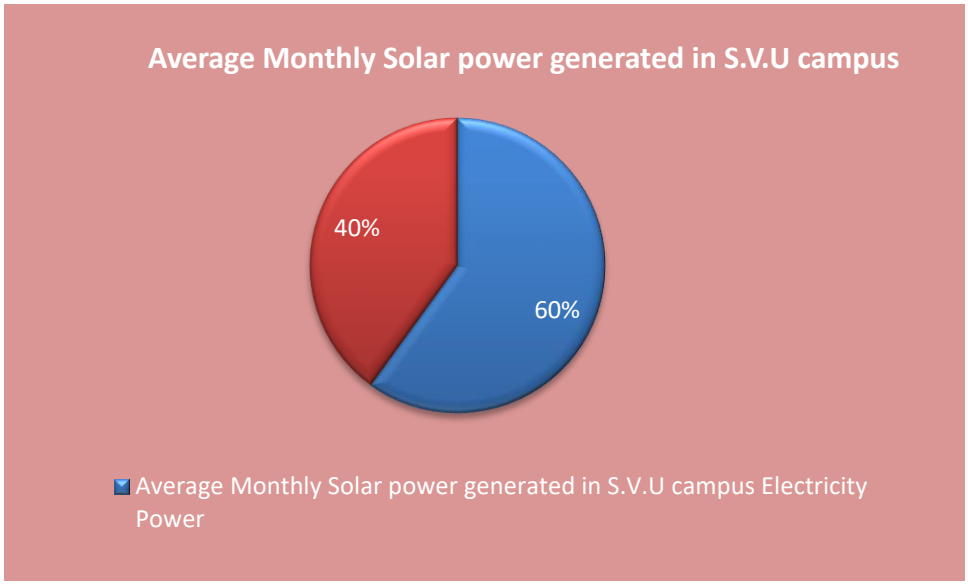


Fig 16: Monthly Solar power generated within S.V.U campus

Fossil fuels (such as petrol, diesel) contribute significantly to environmental pollution through emission of greenhouse gases into the atmosphere mainly as carbon dioxide. Vehicular emissionis the main source of carbon emission in the campus, hence to document the various means of transportation that is practiced by the university members is important. The fuel energy audit determines the approximate use of petrol or diesel by the vehicles inside the university. It also includes the efforts taken by the university to conserve the fuel. The conventional source of fuel for the vehicle is petrol and diesel. Maximum students, teaching and non teaching staff of university and visitors use two wheeler and four wheeler vehicles. So, the data regarding fuel utilization for students, teaching and non teaching staff of university and visitor are monitored in the study.

Carbon Foot Print Analysis

Total number of students on the campus	- 4
Total number of regular faculty	- 206
Total number of Academic Consultants	- 239
Total number of non-teaching staff	- 900
Total number of 2 wheelers used	- 1147
Total number of electrical 2 wheelers	- 41
Total number of 4 wheelers used	- 154
Number of electrical four wheelers	- 04
Average consumption of fuel per month	
By two wheelers	- 458 lts
By four wheelers	- 135 lts

Total consumption of fuel per year – 7116lts

Awareness programmes on effects of CO_2 emission are conducted to encourage usage of electric bikes and cars to reduce on campus air pollution.

Solid Waste Audit

Solid waste is the unwanted or useless solid material generated from the human activities in residential, industrial or commercial area. Solid waste management reduces or eliminates the adverse impact on the environment and human health. A number of processes are involved in efficiently managing waste for an organization. It is necessary to manage the solid waste properly to reduce the load on waste management system. Unavailability of proper waste management practices may lead to environmental pollution. A waste management audit helps educational institutes to efficiently and responsibly dispose of the waste that is generated every day. By designing a more efficient waste disposal program through a waste audit, we can enhance recycling practices

Solid waste generation and its management is a burning issue in current days. The rate of generation of solid waste is very high and yet we do not have adequate technology to manage the generated waste. Unscientific handling of solid waste can create threats to public health and environmental safety issues. Thus, it is necessary to manage the solid waste properly to reduce the load on waste management system. The purpose of this audit is to find out the quantity, volume, type and current management practice of solid waste generation in Sri Venkateswara University campus. This report will help for further solid waste management and to go for green campus development. The waste generated from Sri Venkateswara University campus includes paper waste, plastic waste, biodegradable waste, construction waste, glass waste, biomedical waste and other wastes.

Table No. 1: Category wise solid waste generation at University (kg / month)

Category of waste	Paper waste	Plastic waste	Biodegradable waste	Construction waste	Glass waste	Other waste	Total waste kg/month	Total waste kg/year
Quantity	784	75	2985	123	23	132	**4122**	**49464**
percentage	19.02	01.82	72.41	02.98	00.55	03.20	100	

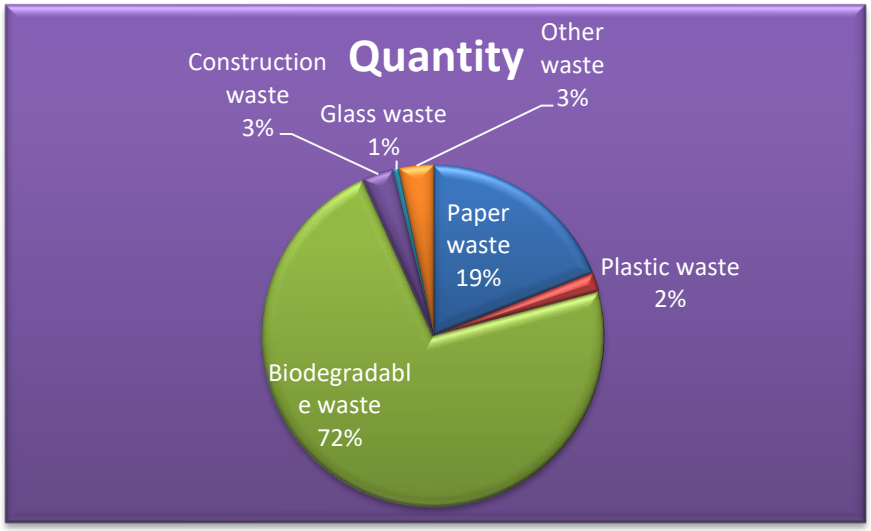


Fig. 17: Graph - Solid waste generation at university campus

Solid Waste Management

Waste is collected and segregated properly. Solid waste is divided into two categories: dry waste and wet waste. Wet waste consist of bio-degradable materials, Dry waste consist of bio-degradable and non-biodegradable materials. Students, faculty, and staff are aware and educated on proper waste management practices of recycling and disposal of plastic waste, paper waste and food waste. Solid and liquid residual waste generated in men and women hostels has been effectively disposed. SV University generated income of Rs.3.0 lakhs/ year through solid and liquid residual waste disposal and also Rs.67.0 lakhs generated by selling paper.

In the University campus premises, Blue and Green covered/ pedal-pushed dustbins are placed for waste collection. Waste bins are provided on each floor, in staff rooms, laboratories, washrooms, kitchen and in campus area. The waste materials like glass, metals, wrappers, papers, plastics, old newspapers, used papers like journal files and workshop scrap etc, are given for recycling to external agencies, where they are segregated and disposed/recycled according to the nature of the waste.

University strictly follows the guidelines regarding plastic usage and has prohibited the use of single use plastic such as carry-bags, glasses, spoons etc, in the campus. As per the College guidelines, Canteen Contractors are prohibited to use plastic cutlery, instead paperplates and wooden spoons are used. The waste from the canteens and other areas are channeled into a reservoir where they are treated biologically before the water goes out into river bodies. Metal scrap is segregated separately and sent for recycling units.

Fig 18: Say No to Plastic

The solvents used in the laboratories are reused after distillation to minimize the use of solvents. The waste solvents are separated as halogenated and non-halogenated and transferred to plastic containers. To prevent heat generation and gas evolution or other reaction, compatibility of the waste is checked carefully.

To prevent accidental spillage of chemicals the laboratory wastes are subjected to process through three stages of waste management. Stage-I gravel, Stage-II sand, Stage –III coal. The three chambers are replenished with new materials after a period of six months.

There is a separate room for the Nuclear Laboratory where radiation hazard is displayed for safety measures. The harmful radiations are radiated by appropriate routes. Containers containing radioactive elements are properly leadsealed.

Wearing appropriate lab coats, gloves and face shields while working with nanomaterials. The hazardous chemical wastes are kept in separate containers. Later they are filtered and drained out.

Biodegradable waste consists of Leaf litter, food waste, vegetable and fruit waste etc. is decomposed in composting, vermicomposting and bio-gas units established in the University campus

Fig 19: Biogas Plant

Other dry waste is collected by Waste collection vehicles of Tirupati Municipal Corporation. Overall University campus is maintained neat and clean throughout. Various awareness programmes were organized in and around campus for effective management of solid waste.

Table-2: Awareness programme on solid waste management in rural areas (10 villages) of Tirupati, Andhra Pradesh.

S.No.	Name of the village (Location)	Date of event conducted	Number of persons attended	Composition of Trainees	Composition of Project Team	Subject of Programme	Number of beneficiaries
1.	Thondavada	14.05.2022	150	People of Thondavada including Harijanawada (Both Men and Women of different ages from 18years to 70 years)	Prof. G. Madhavi and S. Kiranmai	Solid waste management	150
				PHC workers	M. Venu	Elimination of single use plastics	
				SWPC workers	NCC,NSS students	Medical waste awareness	
				Sachivalayam staff	S. Anitha Devi	Sanitary waste awareness	
2.	Peruru	25.05.2022	130	People of Peruru .Both Men and Women of different ages from 21years to 75 years)	Prof. G. Madhavi and P.G.Students of M.Sc Environmental Chemistry, S.V.University	Solid waste management	130
				PHC workers	M.Venu and Research Scholars of Chemistry	Elimination of single use plastics	
				Anganvadi workers	S. Kiranmai, NCC,NSS, Chemistry students	Medical waste awareness	
				Sachivalayam staff	S. Anitha Devi	Sanitary waste awareness	
3.	Thummalagunta	05.06.2022	250	People of Thummalagunta , of different ages from 21years to 75 years)	Prof. G. Madhavi and P.G.Students of M.Sc Environmental Chemistry, Prof. K.V Saritha, Dept of Biotechnology S.V.University	Solid waste management	250
				PHC workers,	M.Venu and Prof. Uma Maheswar Reddy, Dept.of ECE.	Elimination of single use plastics	

				Anganvadi staff	S. Kiranmai ,Prof.M.R.Bhaskar Reddy, Dept.of Geography	Medical waste awareness	
				Sachivalayam staff	S. Anitha Devi, NCC,NSS, Chemistry students	Sanitary waste awareness	
4.	Avilala	18.06.2022	120	People of Avilala. Both Men and Women of different ages from 21years to 75 years)	Prof. G. Madhavi and P.G.Students of M.Sc Environmental Chemistry, S.V.University	Solid waste management	120
				PHC workers	M.Venu and Research Scholars of Chemistry,	Elimination of single use plastics	
				Anganvadi workers	S. Kiranmai, NSS students	Medical waste awareness	
				Sachivalayam staff	S. Anitha Devi, students of B.P.Ed	Sanitary waste awareness	
5.	Tiruchanuru-I	25.06.2022	250	People of Avilala. Both Men and Women of different ages from 21years to 75 years)	Prof. G. Madhavi and P.G.Students of M.Sc Environmental Chemistry, S.V.University	Solid waste management	250
				PHC workers, Municipality workers	M.Venu and Research Scholars of Chemistry	Elimination of single use plastics	
				SWPC workers	S. Kiranmai, NCC&NSS students	Medical waste awareness	
				Sachivalayam staff	S. Anitha Devi	Sanitary waste awareness	
	Tiruchanuru-II (Yogimallavaram)	30.06.2022	96	People of Avilala. Both Men and Women of different ages from 21years to 75 years)	Prof. G. Madhavi and P.G.Students of M.Sc Environmental Chemistry, S.V.University	Solid waste management	96
				PHC workers	M.Venu and Research Scholars of Chemistry	Elimination of single use plastics	
				SWPC workers	S. Kiranmai, students of B.P.Ed	Medical waste awareness	
				Sachivalayam staff	S. Anitha Devi, NCC&NSS	Sanitary waste awareness	

					students		
6.	For NCC & NSS Students of S.V.University	12.05.2022	41	NCC	Prof. G. Madhavi	Solid waste management, Medical waste awareness	103
			62	NSS	M.Venu, S. Kiranmai	Elimination of single use plastics	

Fig 20a: Awareness Programme on Solid waste Management in rural areas around Tirupati

Fig 20 b: Awareness Programme on Solid waste Management in rural areas around Tirupati

Fig 20 c: Awareness Programme on Solid waste Management in rural areas around Tirupati

VERMICOMPOST

Fig 21: Vermicomposting

E-waste generation and management on university campus:

Generation of e-waste is apparent in every educational institute. Especially, at the university level where there are several equipments and instruments used for administrative as well as for scientific execution. Computers, Printers and Xerox machines are must for the administrative and research work. The wires required for the connectivity also gets included in the e-waste. More usage of these electronicas well as electrical materials generates huge amount of e-waste. Similarly, various scientific equipments and instruments get worn out with time. These too contribute to the e- waste.

E-waste include monitor, CPU, key board, electric wire, printer. Paperless work increase load on computer and therefore it is a need to reduce e-waste by repairing all these electric equipment. There is aneed to reuse and recycling of electronic equipments and material. E-waste is collected and stored in University campus and sent to authorised vendor for recycling/ disposal under buy-back policy.

Fig 22: E-waste collection

Biodiversity Audit

Carbon is the basis of life on mother Earth. It is incorporated into the plants through photosynthesis, consumed by animal species through the food, present in the form of carbon dioxide (CO_2) in the atmosphere, locked into the rocks as limestone and compressed into the different fossil fuels such as coal and oil. As CO_2 level in the atmosphere continue to increase, most climate designs or project that the oceans of the world and trees will keep soaking up more than half CO_2 . The plants on land and in the sea, taken up carbon by over many years increased the percentage discharged during decay, and this increased carbon became locked away as fossil fuels beneath the surface of the planet.

The starting of the 21st century brought growing concern about global warming, climate change, food security, poverty and population growth. In the 21st century more carbon has been released into the atmosphere than that has been absorbed. CO_2 is a principle component causing global warming. Atmospheric carbon dioxide levels have increased to 40 % from preindustrial levels to more than 390 parts per million CO_2. On this background it is a need of time to cover the research areas interrelated with climate change.

The “Carbon Sequestration and Green cover inventory” is a current status of tree cover and vegetation carbon storage assessment of area under Sri Venkateswara University campus. In an era of climate change and global warming carbon emission, carbon footprints, carbon sequestration, adaptations, mitigation are the keywords in academia. Carbon sequestration is a process of converting atmospheric carbon i.e. CO_2 into other sinks of carbon such as vegetation, soil, oceanetc. in various forms to mitigate global warming audit is one of the important clauses of Kyoto Protocol.

While transforming ourselves from regional university to global university it is a responsibility of such universities to face the global future challenges and try to find out possible solutions for them. It is a social and environmental responsibility of Government Institutes, Universities, National and International Organizations to respond positively for various global issues at local level and should percolate the generated knowledge in to the society. Global warming and climate change are current environmental issues need to be addressed scientifically and efficiently. As Universities are provided with skillful human resource supported by analytical infrastructure, it is our duty to bring such ideas in practice. While understanding the call of time the Department

of Botany and Environmental Science, Sri Venkateswara University has decided to enumerate the greencover of Sri Venkateswara University campus.

Around 100 M.Sc. Environmental Science and Botany students were involved in the field survey. Team of 4 students was made and one sector was allocated to a team. A team is provided with a measuring tape, chalks, writing pad and tree census form. A tree with girth (circumference of tree) more than 10 cm at chest level and height more than 4 feet were considered as tree and taken for enumeration. Girth of each tree was measured with the help of tape and approximate height by visual method. Identification of tree species was done with the help of field guides, web source and with the help of Taxonomist of Department of Botany of Sri Venkateswara University.

Table -3: List of plant species on Sri Venkateswara University Campus

S. NO	COMMON NAME	BOTANICAL NAME	TYPE/ USE
1	Custard Apple	*Annona squamosa* L. (Var.name:seethapalam)	Fruit yielding, Medicinal
2	False ashoka	*Polyalthia longifolia* (Sonner) Thw. (Naramamidi) -60	Wind breaker
3	False ashoka	*Polyalthia longifolia* Hook. & Thom. Var. pendula (Ontikomma naraamamidi) -51	Wind breaker
4	Snuff-Box Tree	*Oncoba spinoa* Forsk. (Line gulabi) -01	Medicinal
5	Red silk-Cotton tree	*Bombax ceiba* L. (Buruga) -03	Fibre yielding
6	Buddha's coconut tree	*Sterculia alata* -01	
7	Bael	*Agle marmelos* (L.) Corr. (Maredu) -01	Medicinal
8	Tree of heaven	*Ailanthus excelsa* Roxb. (Pedda vepa) -01	Matchstick industry
9	Neem tree	Azadirachta indica A. Juss. (Vepa) -150	Medicinal
10	Indian mahogany	*Chukraia tabularis* A. Juss. (Konda vepa) -01	Medicinal
11	Indian rose wood	*Somyda febrifuga* (Roxb.) A. Juss.	Medicinal, Wood

		(Somi) -02	yielding
12	Ceylon satinwood or East Indian satinwood	*Chloroxylon swietenia* DC. (Billudu) -08	Wood yielding
13	Ceylon Tea	*Cassine glauca* (Rottb.) Kuntz. (Neridi) -06	Medicinal
14	Indian jujube	*Ziziphus mauritiana* Lam. (Regi chettu) -18 1)	Fruit yielding
15	Kath Ber	*Ziziphus xylopyrus* (Retz.,) Willd. (Gotti) -03	Medicinal
16	Notched Leaf Soapnut	*Sapindus emarginatus* Vahl. (Kunkudu) -08	Medicinal
17	Mango	*Mangifera indica* L. (Mamidi) -04	Fruit yielding
18	Indian ash tree	*Lannea coromandelica* (Houtt.) Mann. (Gumpana) -60	Plywood making
19	Flame-of-the-forest	*Butea monosperma* (Lam.) Taub. (Modhuga) -02	Medicinal
20	Indian rosewood	*Dalbergia latifolia* Roxb. (Iridi) -02	Wood yielding
21	Mexican Lilac	*Gliricidia sepium* (Jacq.) Kunth ex Walp. (Seema kanuga) -10	Rat poison
22	Indian beech and Pongame oiltree.	*Pongamia pinnata* (L.) Pier. (Kanuga) -136	Medicinal , Biodiesel preparation
23	Malabar kino	*Pterocarpus marsupium* Roxb. (Yegi) -02	Medicinal
24	Red Sanders	*Pterocarpus santalinus* L.f. (Errachandhanam) -16	Medicinal, Wood yielding
25	Orchid Tree	*Bauhinia purpurea* L. (Deva kanchanam) -02	Medicinal
26	Bidi leaf tree	*Bauhinia recemosa* Lam. (Ari chettu)	Medicinal

		-01	
27	Red cassia, Ceylon senna	*Cassia roxburghii* DC. (Rela) -54	Medicinal
28	Siamese cassia	*Cassia siamea* L. (Seema thangedu) -33	Medicinal
29	Royal Poinciana	*Delonix regia* (Boj. Ex Hook.) Rafin. (Thurai) -12	Ornamental
30	Yellow Flame/ Copper pod	*Peltophorum pterocarpum* (DC.) Baker ex Heyne. (Konda chintha) -272	Ornamental
31	Tamarind	*Tamarindus indica* L. (Chintha) -59	Cuisines , Medicinal
32	Auri,	*Acacia auriculiformis* A. Cunn. ex Benth. (Australia thumma) -02	Ornamental
33	White-bark acacia	*Acacia leucophloea* (Roxb.) Willd. (Thella thumma) -02	Wood
34	Lebbeck /Woman's tongue tree	*Albizia lebbeck* (L.) Benth. (Bagichettu) -16	Forage , Wood
35	Jumbay, white leadtree,	*Leucaena latisiliqua* (L.) Gillis. (Subabulu) -07	Multipurpose tree
36	Badminton ball tree	*Parkia biglandulosa* Wt.& Arn. (Banthi thumma) -02	Ornamental
37	Manila Tamarind	*Pithecellobium dulce* (Roxb.) Benth. (Cheema chintha) -01	Food, Traditional medicine
38	Chilean mesquite	*Prosopis chilenis* (Molina) Stuntz. (Sarkar thumma) -01	Shade tree
39	Rain tree	*Samanea saman* (Jacq.) Merr. J. Wash. (Nidraganneru) -19	Shade tree
40	Arjuna/ Arjun tree	*Terminalia arjuna* (Roxb. ex DC.) Wt. & Arn. (Tellamaddhi) -16	Silk production (Tassar)

41	Baheda	*Terminalia bellirica* (Gaertn.) Roxb. (Thandra) -02	Medicinal
42	Indian almond	*Terminalia catappa* L. (Badam chettu) -02	Food/ wood/ Ornamental
43	Southern blue gum	*Eucalyptus globulus* Labill. (Neelagiri thylam) -52	Essential oil/ Wood
44	Common guava	*Psidium guajava* L. (Jama chettu) -01	Food, Traditional medicine
45	Jamun	*Syzygium cumini* (L.) Skeels. (Neredu chettu) -60	Food medicine
46	Gummy Gardenia	*Gardenia gummifera* L.f. (Bikki) -02	Medicinal
47	West Indian jasmine	*Ixora acuminata* Roxb. (Tella ramabanam) -02	Ornamental
48	Aal or Indian mulberry	*Morinda pubescens* J.E. Smith var. pubecens Verdc. (Maddi) -56	Dye yielding
49	Torch tree	*Ixora pavetta* Andr. (Korivi chettu) -03	Ornamental
50	Madhūka,	*Madhuca longifolia* (K oen.) Macbr. Var. latifolia (Roxb.) A. Cheval. (Ippa) -08	Silk production (tassar) and medicinal
51	Sapodilla	*Manilkara zapota* (L.) P. Royen. (Sapota) -01	Fruit yielding
52	Spanish cherry	*Mimusops elengi* L. (Pogada) -05	Medicinal
53	Caterpillar tree	*Plumeria alba* L. (Tella devaganneru) - 08	Ornamental, Medicinal
54	Pinwheel flower,	*Tabernaemontana divaricata* L. (Nandivardhanam) -02	Ornamental, Medicinal
55	Small Pinwheel flower	*Ervatamia divaricata* (L.) Burkill (Sanna nandivardanamu) -02	Ornamental, Medicinal

56	Sweet Indrajao	*Wrightia tinctoria* (Roxb.) R. Br. (Reppala) -28	Dye yielding, Medicinal
57	Yellow oleander	*Cascabela thevitia* (L.) Lipp. (Patcha ganneru) -04	Poisonous
58	Indian Cherry	*Cordia dichotoma* Forst. (Iriki) -01	Traditional medicine
59	Geiger tree	*Cordia sebestena* L. -01	Ornamental
60	Wavy trumpet flower	*Dolichandrone atrovirens* (Roth) Spr. (Oddi) -02	Ornamental
61	Jacaranda, blue jacaranda	*Jacaranda acutifolia* Humb . & Bonpl. (Swarna sundari) -01	Ornamental, Wood
62	Sausage tree	*Kigelia africana* (Lam.) Benth. In Hook. (Enugu thondamu) -06	Poisonous
63	Tree jasmine or Indian cork tree	*Millingtonia hortensis* L.f. (Manu malli) -05	Ornamental
64	African tulip tree	*Spathodea companulata* P.Beauv. (Yerra neeru budda) -01	Ornamental
65	Silver Trumpet Tree	*Tebebuia argentea* (Bur. & K. Schum.) Britt. -03	Ornamental
66	Rosy trumpet tree	*Tebebuia rosea* (Bertol.) DC. -05	Ornamental
67	Yellow trumpetbush	*Tecoma stans* (L.) Kunth. (Pasupu ganneru) -01	Ornamental
68	Desert teak	*Tecomella undulata* (Sm.) Seem. -02	Wood yielding
69	Teak	*Tectona grandis* L.f. (Teku) -09	Wood yielding
70	Helicopter tree	*Gyrocarpus asiaticus* Willd. (Kummara poliki) -02	Ornamental
71	Great bougainvillea,	*Bougainvillea spectabilis* Willd. -03	Ornamental, Tribal medicine
72	Indian sandalwood	*Santalum albam* L. (Srigandhamu) -	Wood, Medicine

		02	
73	Indian gooseberry	*Phyllanthus emblica* L. (Nellikaya) -07	Culinary, Traditional medicine
74	Indian elm	*Holoptelea integrifolia* (Roxb.) Planch. -09	Cheap wood, Medicinal
75	Banyan	*Ficus benghalensis* L. -44	Cultural significance
76	Sacred Fig	*Ficus religiosa* L. (Ravi chettu) -17	Traditional medicine
77	The common fig	*Ficus carica* L. (Atthi chettu) -01	Food, Folk medicine
78	Australian pine tree or whistling pine tree	*Casurina littorea* L. (Sarugudu) -02	Wood, Ornamental
79	Traveler's palm	*Ravenala madagascarensis* Sonner. (Panka arati) -01	Ornamental
80	Indian shot	*Canna indica* L. (Metta thamara) -02	Ornamental
81	Thorny bamboo	*Bambusa arundinacea* (Retz.) Roxb. (Veduru) -02	Wood for thatching
82	Toddy Palm	*Borassus flabellifer* L. (Tati chettu) -01	Edible, Palm wine
83	Cuban royal palm	*Roystonea regia* (Kunth) O.F. Cook. -20	Ornamental
84	Yellow Cane Palm	*Dypsis lutescens* (H.W endl.) Beentje & J. Dransf. -14	Ornamental

Custard Apple

Indian mahogany

Indian ash tree

Flame-of-the-forest

Red cassia, Ceylon senna

Arjuna/ Arjun tree

Sweet Indrajao

Rosy trumpet tree

Silver Trumpet Tree

Geiger tree

Indian elm

Cycas beddomei

*Couroupita guianensis (*Cannonball tree) Indian sandalwood

Fig. 22: Plant species on Sri Venkateswara University Campus

In ecology, the mass of living biological organism in a given area or ecosystem at a given time is called as biomass. Biomass can refer to species biomass and community biomass. The species biomass is the mass of one or more species. The community biomass, which is the mass of all species in the community. It includes microorganisms, plants or animals. The mass can be defined as the average mass per unit area, or as the total mass in the community.

To estimate the biomass of the each individual tree species non- destructive method was used. To calculate the circumference Diameter at Breast Height (DBH) can be determined by measuring tree Girth at Breast Height (GBH), approximately at 1.3 meter from the ground. The Girth at Breast Height of trees having diameter which greater than 10 centimeters were measureddirectly by measuring tape.

To maintain green cover and carbon sequestration potential of the University following precautionary measures were taken.

Plantation of endemic species like *Pterocarpus santalinus, Cycas beddomei,Boswelia ovalifoliata, Syzyzium cumini* etc were planted to conserve native biodiversity. The plantation of tree species like *Acacia nilotica subsp. indica, Albizia lebbeck,*

Azadirachta indica, *Citrus aurantium* works as green belt which can maintain the ecological balance in the environment as well as act as sink for the harmful gases and improve air quality. Plantation activity is taken every year to increase the green cover on the University campus. Avoided the plantation of exotic species like *Casuarina*, which is fast growing species with less ecological values. Sri Venkateswara University received **:** IS0 14001: 2015 certificate for Implementation of Greenary and Environmental Promotion Activities

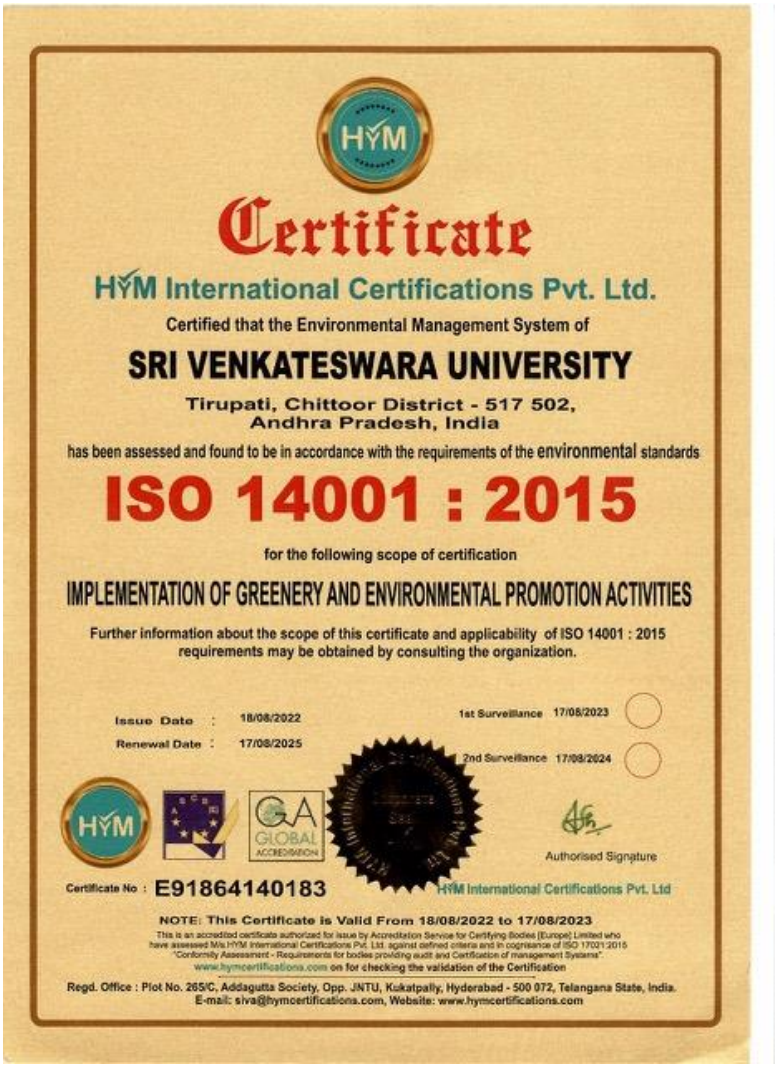


Fig. 23: IS0 14001: 2015 Implementation of Greenary And Environmental Promotion Activities

India has large geographical size and variety of climate and habitats. Wild animals constitute great national resources. Preservation and protection of wildlife is important from the ecological point of view. As per the UNESCO's Man and Biosphere program, the government of India has established the Seshachalam Biosphere Reserve on 20th September,

2010. The reserve is the first biosphere reserve in Andhra Pradesh and the 17th in India. By size, it is the 9th largest in India.

Sri Venkateswara University is located at foot hills of Tirumala of Seshachalam hill range a Biosphere reserve spread over in area of 480 acres with lush green campus possessing more than ten thousand different kinds of plants. At North side of the campus are seven peaks of, Eastern Ghats namely Seshadri, Neeladri, Garudadri, Anjanadri, Vrushabadri, Narayanadri and Venkatadri. Being covered with hilly region and green luxurious coverage the Sri Venkateswara University harbours different species of birds, insects, reptiles, deers and rabbits etc. In addition to above plant species a diversified fauna has been observed and documented.

Students of department of Zoology involved in counting Bird population in the campus from 18 – 21, February, 2022. As part of the program 44 different species of birds observed and posted in eBird India web page.

Fig 24: Bird count in Sri Venkateswara University Campus

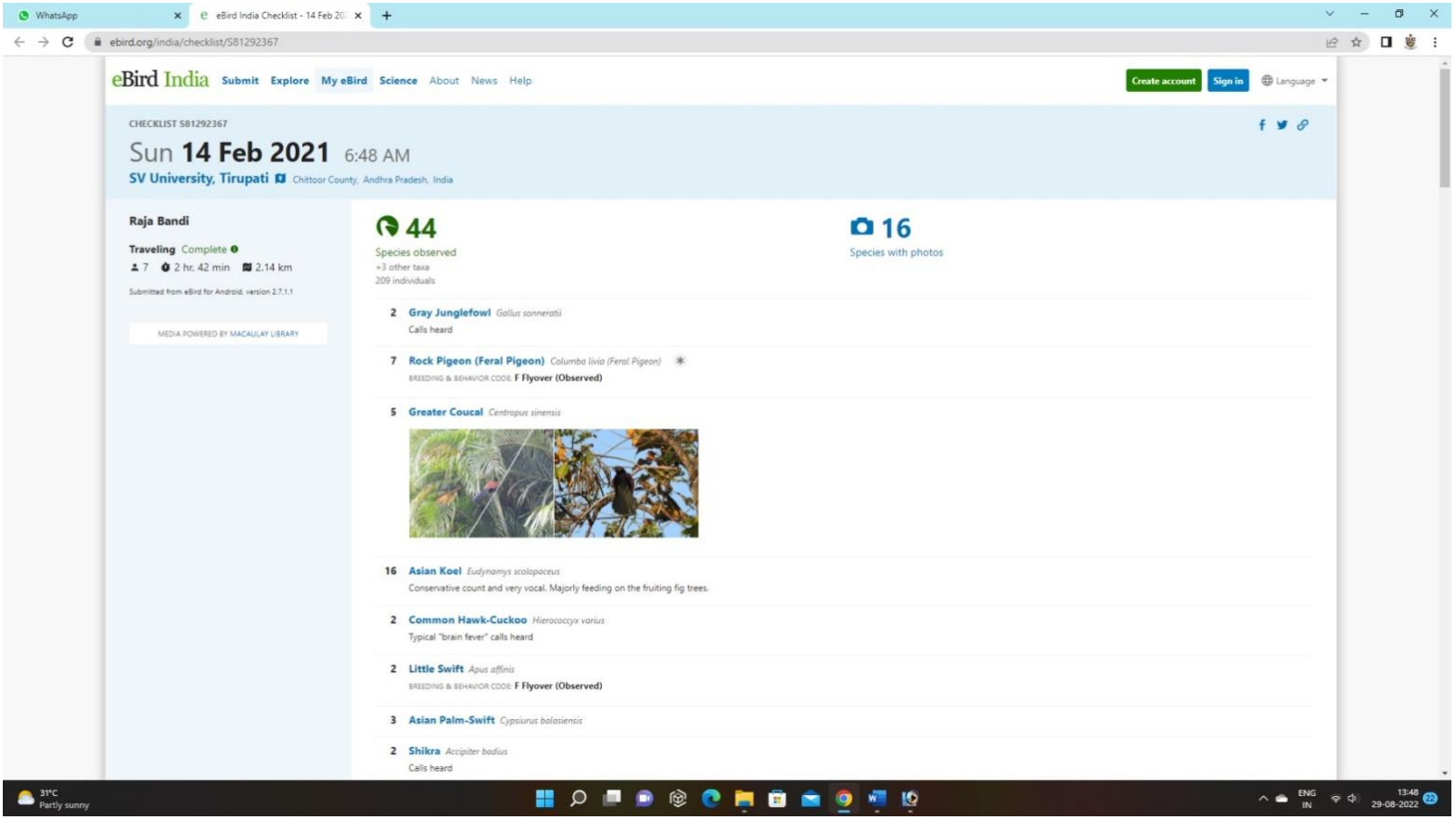


Fig 25: eBird India WEB PAGE

https://ebird.org/india/checklist/S81292367

Greater Coucal *Centropus sinensis*

Asian Koel Eudynamys scolopaceus

Common Hawk-Cuckoo ***Hierococcyx varius***

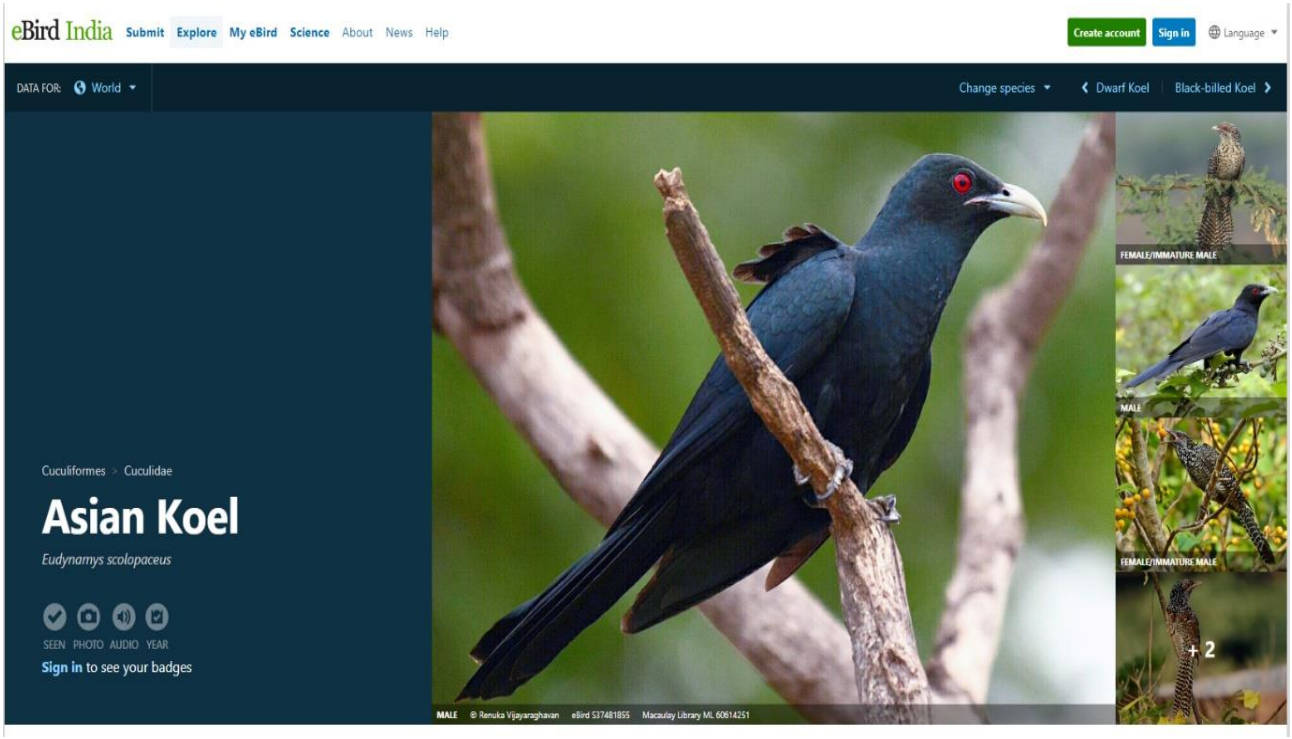
White-throated Kingfisher ***Halcyon smyrnensis***

Rose-ringed Parakeet ***Psittacula krameri***

Common Tailorbird *Orthotomus sutorius*

Common Tailorbird *Orthotomus sutorius*

Black-headed Cuckooshrike *Lalage melanoptera*


eBird India
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Science
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Create account
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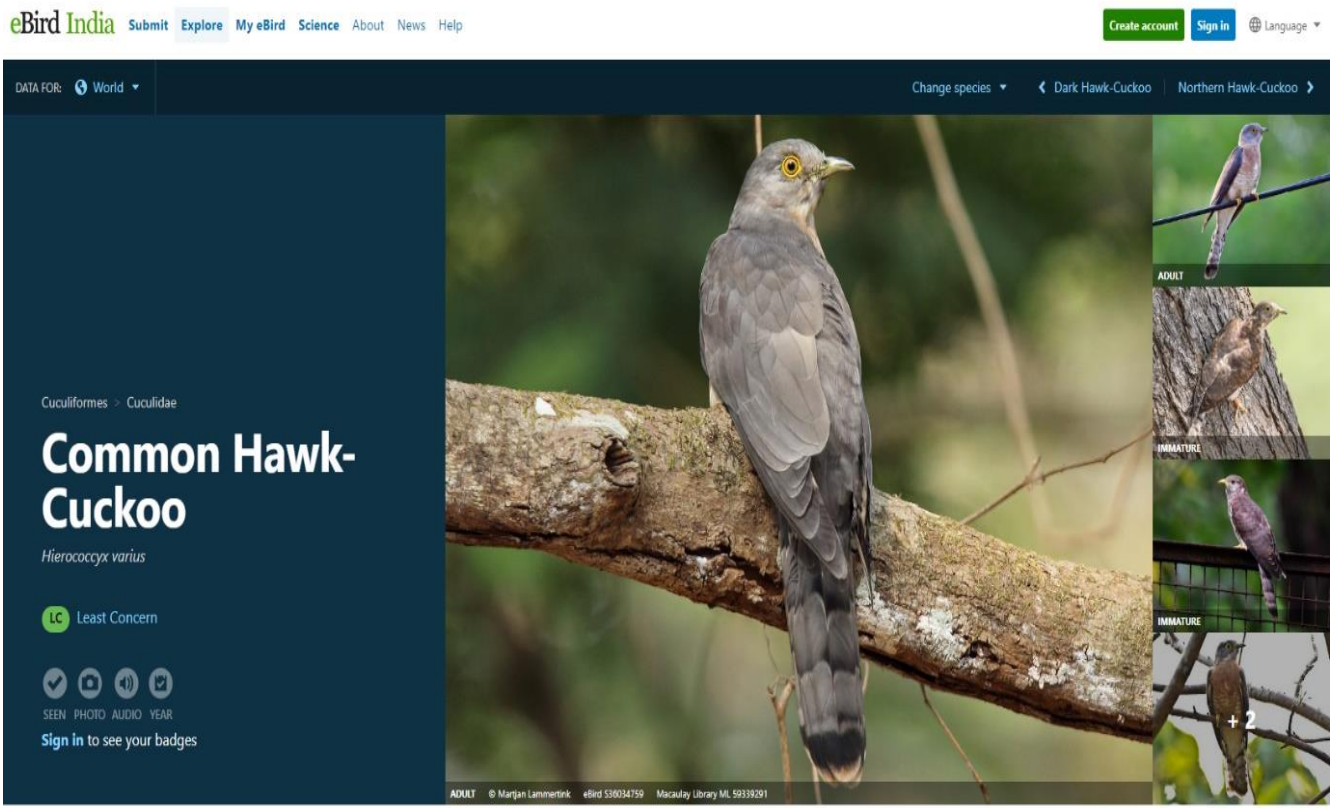
DATA FOR: World
Change species
Dwarf Koel
Black-billed Koel
Cuculiformes > Cuculidae
Asian Koel
Eudynamys scolopaceus
SEEN PHOTO AUDIO YEAR
Sign in to see your badges
FEMALE/IMMATURE MALE
MALE
FEMALE/IMMATURE MALE
+ 2
MALE © Renuka Vijayaraghavan eBird S37481855 Macaulay Library ML 60614251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DATA FOR: World
Change species
Dark Hawk-Cuckoo
Northern Hawk-Cuckoo
Cuculiformes > Cuculidae
Common Hawk-Cuckoo
Hierococcyx varius
LC Least Concern
SEEN PHOTO AUDIO YEAR
Sign in to see your badges
ADULT
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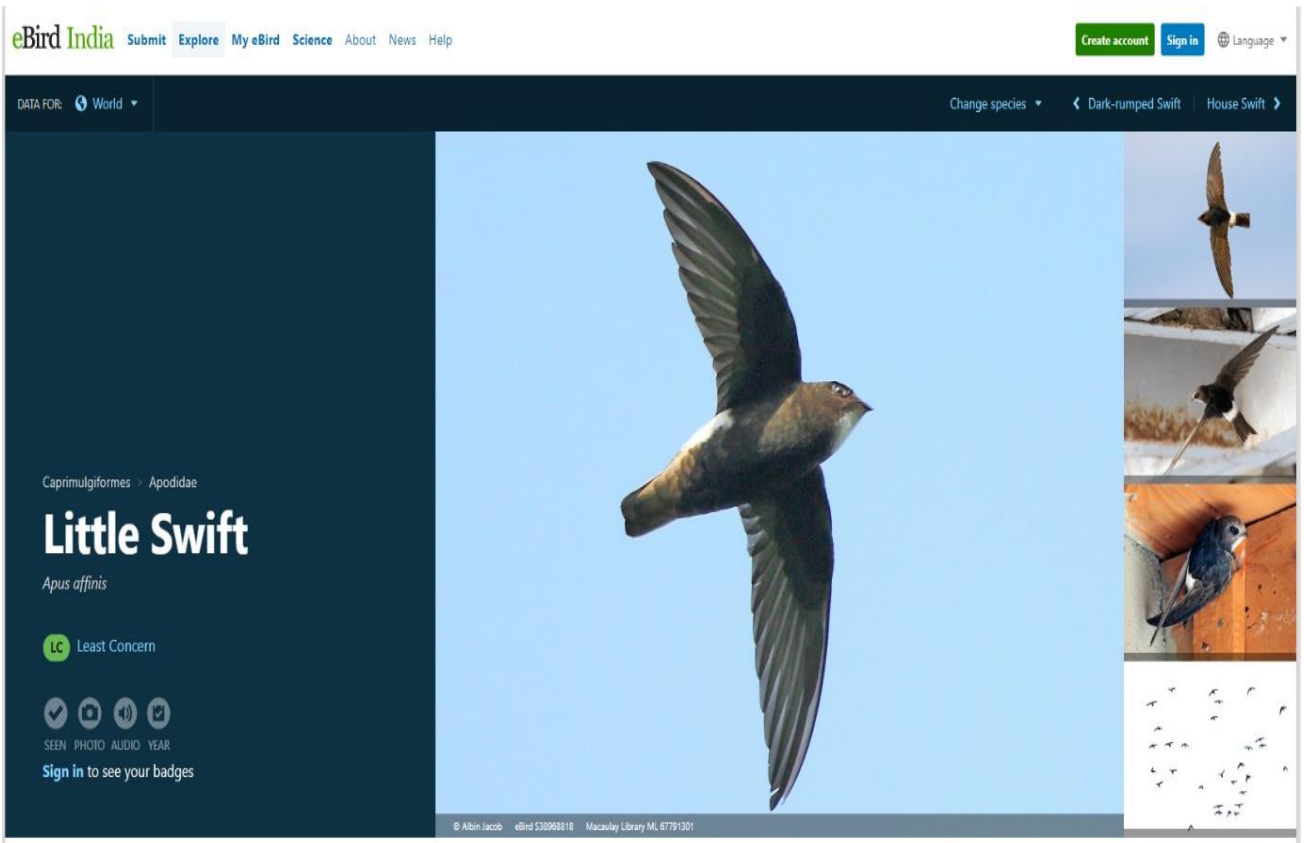
+ 2
ADULT © Marjan Lammertink eBird S36034759 Macaulay Library ML 59339291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Change species
Dark-rumped Swift
House Swift
Caprimulgiformes > Apodidae
Little Swift
Apus affinis
LC Least Concern
SEEN PHOTO AUDIO YEAR
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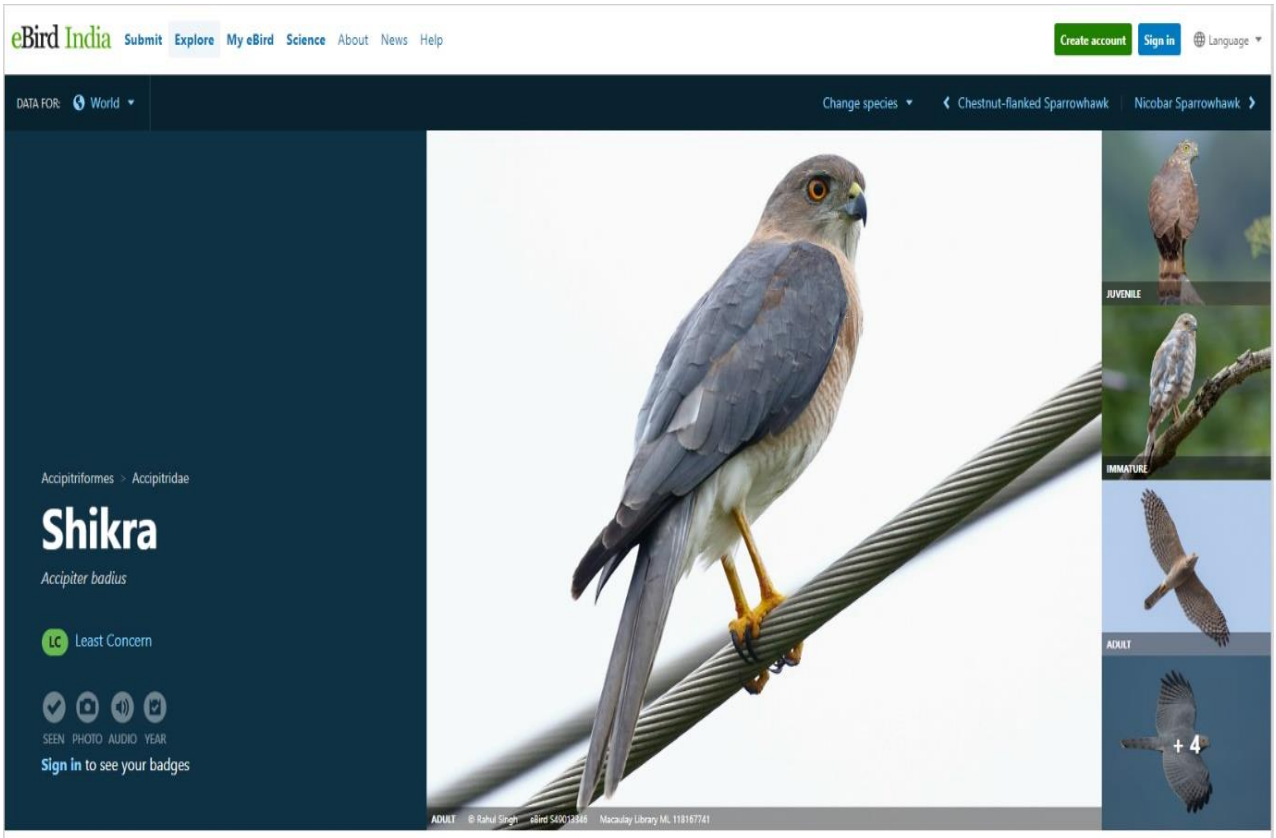
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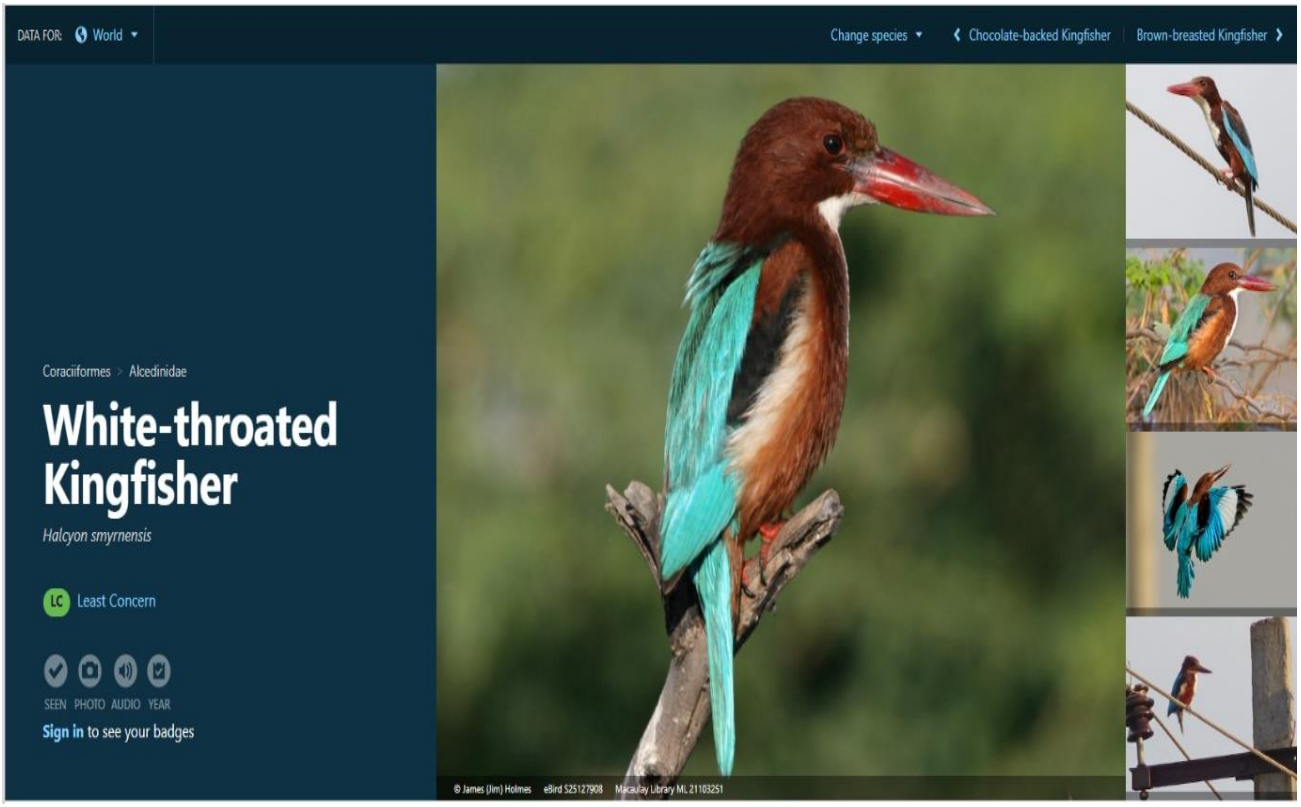
Change species
Chestnut-flanked Sparrowhawk
Nicobar Sparrowhawk
Accipitriformes > Accipitridae
Shikra
Accipiter badius
LC Least Concern
SEEN PHOTO AUDIO YEAR
Sign in to see your badges
JUVENILE
IMMATURE
ADULT
+ 4
ADULT © Rahul Singh eBird S40013846 Macaulay Library ML 118167741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Brown-breasted Kingfisher
Coraciiformes > Alcedinidae
White-throated Kingfisher
Halcyon smyrnensis
LC Least Concern
SEEN PHOTO AUDIO YEAR
Sign in to see your badges
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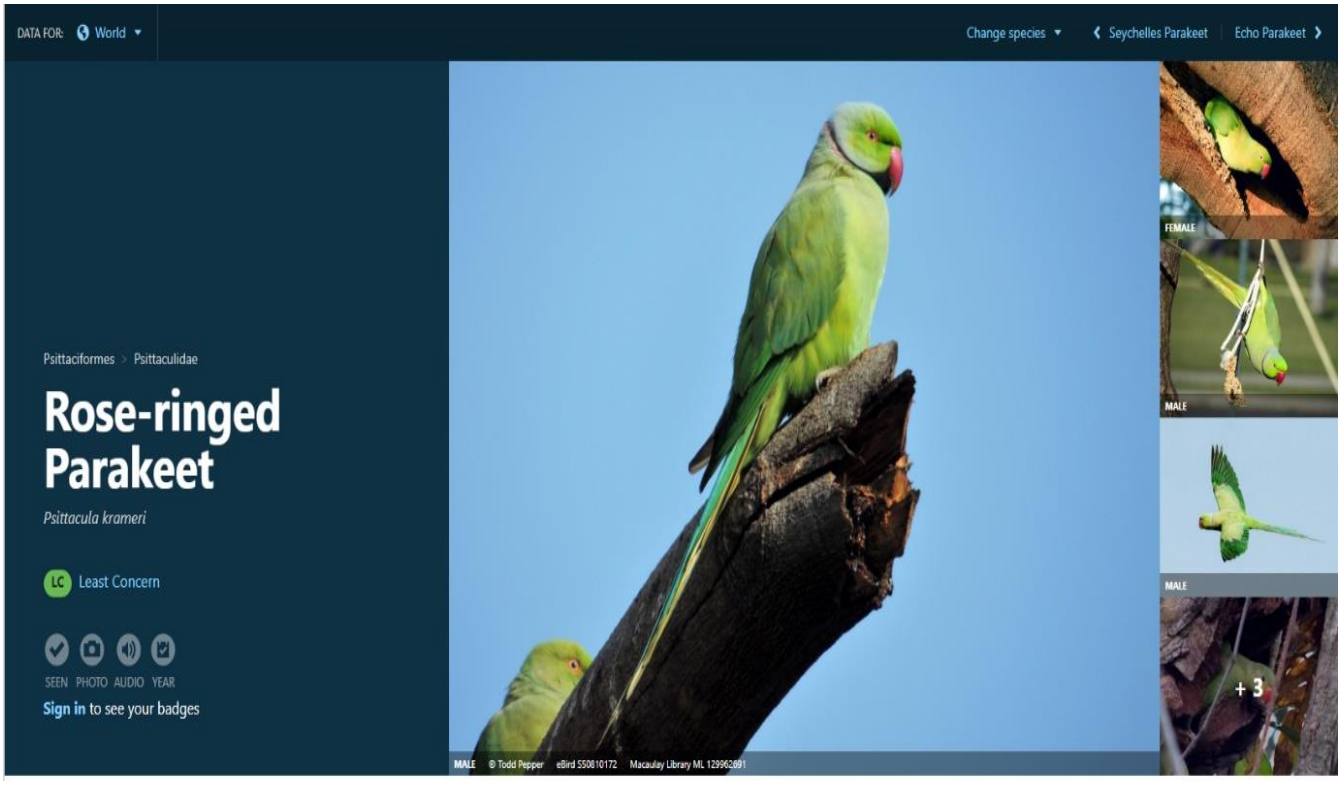
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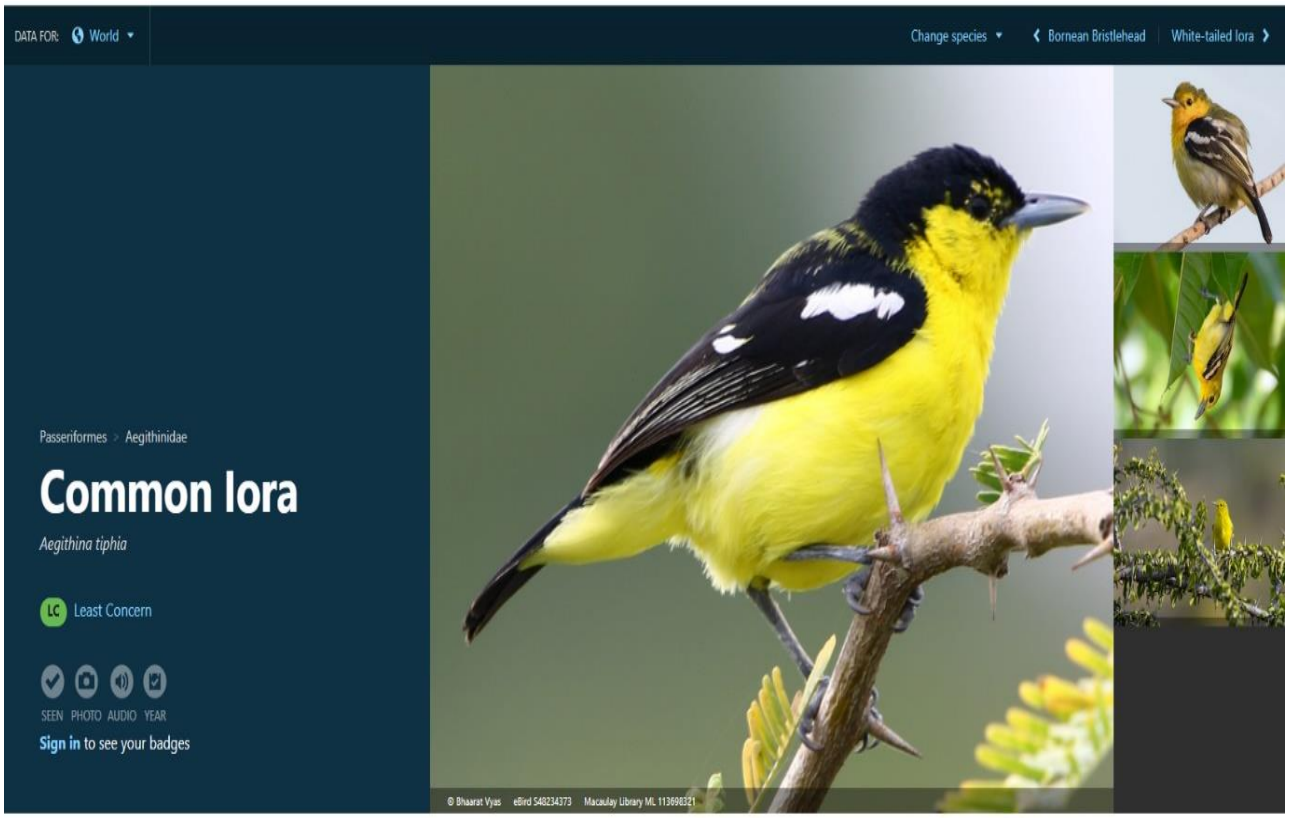
Change species
Seychelles Parakeet
Echo Parakeet
Psittaciformes > Psittaculidae
Rose-ringed Parakeet
Psittacula krameri
LC Least Concern
SEEN PHOTO AUDIO YEAR
Sign in to see your badges
FEMALE
MALE
MALE
+ 3
MALE © Todd Pepper eBird S50810172 Macaulay Library ML 129962891



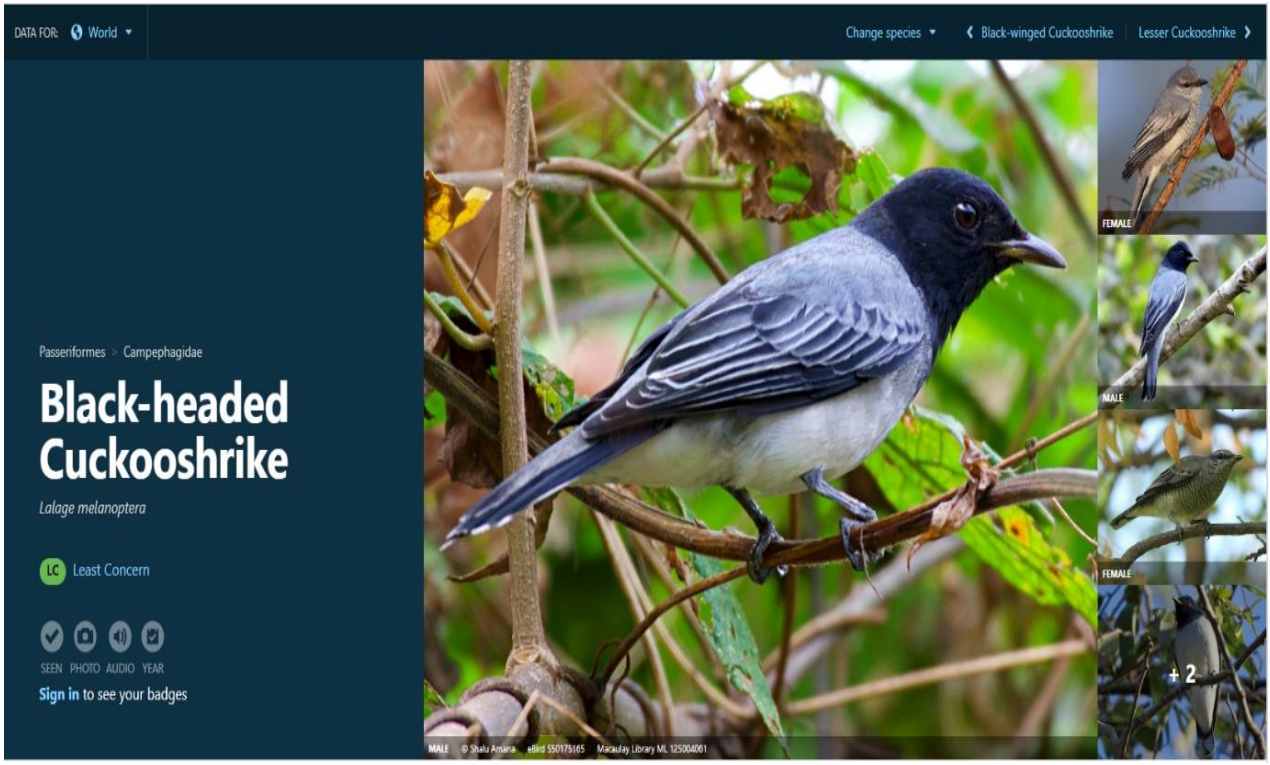


Fig 26: Birds at Sri Venkateswara University camp

The Director
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S.V. University
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