



GREEN AUDIT REPORT 2018-19



UNIVERSITY OF SCIENCE & TECHNOLOGY MEGHALAYA

GREEN AUDIT COMMITTEE

SI No	Name and Affiliation	Designation
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2	Dr Parag Phukon, Professor, Department of Geological Sciences, Gauhati University	Member
3	Dr Utpal Sarma, Associate Professor, Dept of Instrumentation & USIC, Gauhati University	Member
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6	Dr Swarup Jyoti Baishya, Asst Professor, Dept of Earth Science	Member
7	Dr Jyotisman Dutta, Asst Professor, Dept of Botany	Member
8	Dr Prabal Sarkar, Associate Professor, Dept of Zoology	Member
9	Mr Shamim Akhtarul Goney, Deputy Registrar (Administration)	Member

Preface

University of Science & Technology Meghalaya is always concerned with the environmental issues to receive the best of attention. Improvement of environmental quality is one of the primary objectives of the University and towards achieving a better environmental health, a self-enquiry on the environmental quality in the campus has been made. This status report is second of its kind and expects that subsequent enquiry will be made on a periodic interval to keep us aware of the environmental status. The Green Audit Committee constituted by USTM for the year 2018-2019 deliberated on various environmental issues, identified gaps and suggested measures for improvement. It is always heartening to see incremental progress shown due to efforts of University authority. Documentation of the status of environment is an essential component for developing a holistic concept of a University. This report is a compilation of records available as well as new data/information generated as a part of audit.

It is to be admitted that there are limitation in compilation because concept of green audit had late entry into the University system. However this compilation provides an overall insight into the status of campus.

The effort of the committee is commendable in arriving at some important observations which will have definite contribution in our effort for a better environment.

LAND COVER AND LAND USE

Land use / Land cover is result of combined activities of physical and human activities. Land use and Land cover change detection is essential for understanding of physical environment, ecological process, soil erosion, deforestation and also helpful in planning purposes. The landscape of USTM is hilly in nature. Various academic departments, hostels, auditorium come up at the barren hills while the large portion is left as natural green cover. After preparing LULC map form Google Earth shows a total of 80.895 acres of land in the main campus of which 30.939 acres are under natural forest, and 1.909 acres under garden area. Organized plantations in the campus are mainly along the internal roads and together with the different academic departments, they add to the overall green cover. The green cover including natural forests, garden and plantations, form 45.825 percent of total area. USTM campus home to wide diversity of aquatic flora and fauna. Efforts have been made in the campus to conserve natural forests.

SL.NO.	CATEGORIES	AREA (ACRES)	PERCENTAGE
01	Admin Block	0.121	0.149
02	Amenity Centre	0.109	0.134
03	Barren Hill	0.776	0.960
04	Academic Blocks	0.909	1.124
05	Botanical Garden	0.101	0.125
06	Bus Stand	0.019	0.024
07	Canteen	0.030	0.037
08	Central Auditorium	0.676	0.836
	Construction Site For Medical		
09	College	5.103	6.308
10	Culvert	0.049	0.060
11	Drains	0.142	0.175
12	Forest	25.294	31.267
13	Garden	0.538	0.665
14	Gate	0.008	0.009
15	Herbal Garden	1.270	1.570
16	Hut	0.008	0.010
17	Kasturba Girl's Hostel	0.165	0.204
18	Marshy Area	2.489	3.077
19	Natural Vegetation	5.645	6.978
20	Nursery Hut	0.037	0.046
21	Open Space	11.745	14.519
22	Over Foot Bridge	0.006	0.008

Table 1: LULC categories in campus

23	Parking Area	0.506	0.625
24	Pascal Girl's Hostel	0.152	0.188
25	Pedestrian Step Road	0.160	0.197
26	Plantation	6.132	7.580
27	Playground	1.693	2.093
28	Pond	2.208	2.729
29	Residential Area	0.114	0.140
30	Retaining Wall	0.173	0.214
31	Workshop	0.159	0.196
32	Road	8.441	10.435
33	Rock	0.104	0.129
34	Site (Medical College Hospital)	4.454	5.506
35	SSb Boy's Hostel	0.364	0.450
36	Stairs	0.009	0.012
37	Temporary Shed	0.152	0.188
38	Transformer	0.006	0.007
39	TSB Hostel	0.180	0.223
40	USTM Main Gate	0.005	0.007
41	USTM Play Ground	2.184	2.700
42	Wall	0.253	0.313
43	Water bodies	0.087	0.107
44	Wifi Tower	0.011	0.013
	TOTAL	80.895	100.000

Source: Google Earth

Built up environment

Table 1 shows different types of LULC area. It is found that a total of about 12.927 acres (15.978 % of total) are under the built up category, of which hostels, roads, and academic departments form a significant part. In absence of available plain area for further new constructions, hills were used for construction of medical colleges and hospitals. In general, the campus presents a perfect environment with lush green cover with many varieties of flora. A peaceful environment is an improvement in recent times by conserving surrounding green cover.



Figure 1: Detail LULC components of USTM Campus, Meghalaya, India



Figure 2: Percentage distribution of LULC classes.

GREEN AUDIT

ENVIRONMENTAL:

Noise level

A sound level meter was used to measure noise level at different locations of USTM campus during working hours in the Month of February 2019. Results are shown in Table 1.

Table 1. Noise level in campus

Sl no	Location	Minimum	Maximum	Average level
		level	level (dB)	(dB)
		(dB)		
1	Central Library	41.2	62.3	58.5
2	Amenity Centre	60.4	73.5	66.7
3	Gyan Circle	48.1	90.7	70.3
4	Corridor, H block	42	53	48
5	In front of G block	50.5	57	52.5
6	Administrative block	52	56.8	55
7	In front of Annexe 1	40.4	52	44.2
8	Block C	53	67	55
9	Block E	43.7	63	57



Central Pollution Control Board has laid down the permissible noise level in India for different areas. In industrial areas, the permissible limit is 75 dB for daytime and 70 dB at night. In commercial areas, it is 65 dB and 55 dB while in residential areas it is 55 dB and 45

dB during daytime and night respectively. In silent zone, permissible limit in day time is 50 Db and in night time the value is 40 dB. Cause of noise at different locations of USTM campus are shown in Table 2.

Sl no	Location	Source of noise
1	Central Library	Movement of Ceiling fan, Whispering by students,
		movement of chairs by students
2	Amenity Centre	Gossiping/ talking by customers (mainly students and
		faculties), Chair movement, sound from generator
3	Gyan Cirle	Movement of vehicles, Construction work
4	Administrative block	Talking
5	Block C, E	Human movement, Talking, sound from generator
6	In front of blocks	Human movement, Talking, Birds

Table 2. Source of noise

Due to construction work, noise level in different blocks is more. However, it is temporary. Movement of vehicles during 10 AM- 4 PM is less except during 3PM- 3.30 PM when students of RIST leave campus.

Water Quality Status





There are natural water bodies in the university campus. Overall view of the water bodies is good and support aquatic birds and other organisms. Major threat to water quality in the water bodies are sediments from construction work and/ or cutting of hills for development purpose.

Turbidity

Turbidity is a measure of clarity of a liquid. If is an optical characteristic of water and is an expression of the amount of light that is scattered. Turbidity makes water cloudy or opaque. Turbidity of water in ponds of USTM campus was estimated using a Secchi Disc in Nephelometric Turbidity Unit.



Table 3. Turbidity of water samples

Sl no	Location	Turbidity (NTU)
1	Pond near park	10
2	Pond near girls' hostel	23

Turbidity of waterbody near the Girls' hostel is comparatively more due to construction activities, sediment transport and decomposition of leaves etc.

pH of water samples:

pH is a measure of how acidic/basic water is. The range goes from 0 to 14, with 7 being neutral. pH of less than 7 indicate

acidity, whereas a pH of greater than 7 indicates a base. The pH of water is a very important measurement concerning water quality. pH of water bodies and piped water in USTM campus was estimated using pH meter. The results are shown in Table below:

Table 4. pH of water samples

Sl no	Sample	pH value
1	Pond water	6.3
2	Piped water-1	7.6
3	Piped water-2	7.7

pH was found slightly acidic in pond water whereas pHwas slightly basic in piped water samples

Solid waste generated from shops, canteens etc.						
Name of shop	Туре	Food taken by (no of persons in a day)	Major waste generated	Amount of waste in a day(Appr ox.)	Disposal site/ mechanism	Suggestions/ requirements (by shop keeper/manage r)
Techno Cafe	Food Canteen	600	Food waste, plastic, paper	50 kg	Near hostel block B	Daily waste collection and proper management
Urban Junction	Food Canteen	150	Disposable cups, plastic, vegetables (peels)	10 kg	Carried by self and thrown in the bin in front of hostel block B	Bigger dustbin should be provided
Chai Lo	Food canteen	50	Paper cups/glass, straws, food	20 kg	Disposed at place designated	Regular pick- up
Biryani House	Food canteen	60	Paper, Plastics, food waste	20 kg	Wastes are carried by cleaners and thrown at the backside of boys hostel	Regular collection and proper management
JB Food corner	Food canteen	25	Paper, Plastics, food waste	15 kg	Collected at dustbin and then thrown at front side of new hostel	Regular collection and proper management
Medishop & Health Care	Medisho p		Paper etc.	1 kg/week	Collected by cleaner	Regular collection, proper management
		Sol	id waste generat	ted in hostels	s	
		Food	Average			

Hostel	No of boarders	prepared for (persons)	amount of waste generated in	Major waste generat	r Waste e disposal ed mechanisn	Other comments
Hostel Block A TS Boys Hostel	290	270	a day 50 kg	Wastag food waste	collected a ge, dustbin, the taken by loc people for p	at No major en problem as of cal now ig
Hostel Block B SS Boys Hostel	286	286	60 kg	Food waste wastag plates	Taken by , local peopl e, for pig etc	-do- e
Pascal Girls Hostel	40	44	12 kg	Food waste	Feeding th domestic animals	e
Solid waste generated in academic blocks/ buildings						
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Total solid waste generated from all shops in a day: 115kg (Approx.) Total solid waste generated from all hostels in a day: 120 kg (Approx.)

Total solid waste generated from all other blocks/buildings in a day without any event/ function: 20 kg (Approx.)

Biodiversity Audit

Conservation of biodiversity is an important global challenge to ensuring future sustainability. Biodiversity not only supplements our lives through economic, scientific and cultural aids, but more importantly, it maintains the functional and ecological balance of the environment. As such it is considered as one of the key pillars of sustainable development. Despite its important roles in sustainable development, biodiversity and its ecosystem

services continue to be degraded and lost at unprecedented rates. The recent regional assessment reports by the "Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)" found that biodiversity is in decline in all regions of the world.

The world's population is projected to increase from around 7.6 billion today to close to 10 billion people by 2050. The corresponding global demand for food is estimated to grow by 50 percent during this period, introduction enormous pressure on productive land, particularly in developing countries. Land-use changes will further result in a loss of valuable habitats, land degradation, soil erosion, a decrease in clean water and the release of carbon into the atmosphere. The Global Forest Resources Assessment (FRA), coordinated by FAO, found that the world's forest area decreased from 31.6 percent of the global land area to 30.6 percent between 1990 and 2015, but that the pace of loss has slowed in recent years. As such, a landmark event "United Nations Decade on Ecosystem Restoration, 2021-2030" was apprehended as a means of highlighting the need for greatly increased global cooperation to reestablish degraded and destroyed ecosystems, contributing to efforts to combat climate change and safeguard biodiversity. The 6th Global Biodiversity Summit of Local and Subnational Governments including representatives of the countries parties, observer countries and international organizations was held in Sharm el-Sheikh, Egypt, in parallel to Convention on Biological Diversity (CBD) COP 14, November 2018 to negotiate agreements and commitments that give impulse to the conservation and sustainable use of biodiversity as well as the implementation of the Strategic Plan for Biodiversity 2011-2020

As a part of the action towards the conservation of biodiversity and to promote a green campus, various assessmentsare being made toreinforcethe biodiversity wealth within the campus, starting with the construction of Botanical Garden, Green house, Nursery, Biodiversity Parkand also proper documentation of existing plant species (Figure. 1A & 1B). Over the past years, several efforts fortree plantation drives havealso been carried out by the University under teacher-student initiative within the campus (Figure. 1C).A more detail account on the campus biodiversity, both floral and faunal was given in (Table 1, 2 and 3).

and the Aichi Biodiversity Targets.



Figure 1: A) Establishment of Botanical Garden, Green house, Nursery; B) Biodiversity Park and C). Plantation drives within the University Campus

Floral Diversity in Campus

The primary mission for encouraging theUSTM Campus vegetation is to create a green campus, enhance the educational, societal awareness and aesthetic value of the campus. University of Science and Technology Meghalayacampus is located within the geo-

coordinates of latitude 26.103° N and longitude 91.846°E in Meghalaya, India. It encompasses an area of about 400 acre. The campus is situated in a hilly terrainand is covered by tropical moist deciduous forest comprising ofwide variety of species. Proper documentation for the existing species has been conducted by survey method in the USTM campus in the year 2018-19, which led to identification of as many as 40 herbs and shrubs, 45 Species of tree.Most of the tree species are growing naturally and few of them are either exotic or planted in different areas within the campus (Figure 2 and 3). However the present lists of tree, shrubs and herbs species represented only less than 50% of the total species actually available in USTM campus. Further most of the herbs and shrubs species present within the campus are either medicinal or used as vegetables. But proper documentation of most of the species are still lacking. As such continuous efforts are being made for proper documentation of the species, so that peoples in general and students in particular, can use themfor taxonomic and research purpose.Proper maintenance of vegetation within the campus will also serve in providing an extended classroom and living laboratory for the students.Hence, proper conservation initiative is required for these species in the campus.It was further hoped that, the all university campuses will together act as a single large entities in putting a huge impacts on the environment and overall ecosystem sustainability.



Delonix regia



Terminalia arjuna



Erythrina variegata



Bambusa tulda





Schima wallichii

Figure 2: Few important Tree species found within the USTM campus







Ricinus communis

Ixora coccinea

Setaria viridis



Yucca filamentosa



Cycas revoluta



Livistona japonica



Hevea brasiliensis



Costus speciosus



M. malabathricum

Figure 3: Few important herb, shrub and ornamental species found within the USTM campus

Floral diversity details

Table1: Diversity of Herb species

SN	Common Name	Scientific Name	Family
1	Common trumpetvine	Allamandacathartica	Apocynaceae
2	Setariapallide-fusca	Arundinellabengalensis	Poaceae
3	Common rabi weeds of India	Blumealacera L.,	Asteraceae
4	Indian timber bamboo	Bambusatulda	Poaceae
5	Papper flower	Bougainvillea spectabilis Wild.	Nyctaginaceae
6	Asian pigeonwings	Clitoriaternatea	Fabaceae
7	Croton plant	Croton tiglium	Euphobiaceae
8	Coleus	Coleus scutellarioides	Araceae
9	Bamboo	DendrocalamushamiltoniiNees.	Poaceae
10	Pleomele dracaena	Dracaena reflexa Lam.	Asparagaceae
11	Cogongrass	Imperatacylindrica	Poaceae
12	Banana tree	Musa champaca Hort.	Musaceae
13	Basil plant	Ocimum sanctum	Lamiaceae
14	Phyllanthus	Phyllanthusnururi	Euphorbiaceae
16	Fence bamboo	Phyllostachysmannii Gamble	Poaceae
17	Mexican flame flower	Poinsettia pulcherrima	Euphorbiaceae
18	Snake tongue	Sansevieriaroxburghiana	Asparagaceae
19	Yellow foxtail	Setariapallide-fusca	Poaceae
20	Tridax daisy	Tridaxprocumbens	Asteraceae
21	Broom grass	ThysanolaenaagrostisNees.	Poaceae
22	Dandotapala	Vernoniacinerea	Asteraceae

Table 2: Diversity of Shrub species

SN	Common Name	Scientific Name	Family
1	Sentry plant	Agavaeamericana L.	Asperagaceae
2	Camellia	Camellia japonica	Theaceae
3	Key lemon	Citrus aurentifolium	Rutaceae
4	Grapefruit plant	Citrus paradise Macf.	Rutaceae
5	Variegated croton	Codiaeumvariegatum L Bl.	Euphorbiaceae
6	Spiral ginger	Costus specious	Costaceae
7	Duranta	Durantaerecta L.	Verbenaceae
8	China rose	Hibiscus rosasinensis L.	Malvaceae
9	Jungle geranium	IxoracoccineaRoxb.	Rubiaceae
10	Malabar melastome	Melastomamalabathricum	Melastomiaceae
11	Red flag bush	M.erythrophyllaSchumach&Thonn	Rubiaceae
12	Castor oil plant	Ricinuscommunis	Euphorbiaceae
13	Rose plant	Rosa indica	Rosaceae
14	Needle wood tree	Schimawallichi DCKorth.	Transtromiaceae

15	Hairy-fruited eggplant	Solanumferox L.	Solanaceae
16	Pinwheelflower	Tabernaemontanadivericata L R.Br.	Apocynaceae
17	Indian paint	Tradescantia tricolor	Commelinaceae
18	Yucca plant	Yucca aloifoliavariegataNaudin	Asparagaceae

Table 3: Diversity of Tree species

SN	Common Name	Scientific Name	Family
1	Australian acacia	Acacia auriculiformis A. Cunnn. Ex. Benth	Mimosaceae
2	Lebbeck tree	Albizialebbeck	Fabaceae
3	Devil tree	Alstoniascholaris L R. Br.	Apocynaceae
4	Burflower-tree	Anthocephaluscadamba	Rubiaceae
5	Agar tree	AquilariamalacensisLamk.	Thymelaeceae
6	Norfolk pine	Araucaria excelsa R.Br.	Araucariaceae
7	Betelnut tree	Areca catechu L.	Aracaceae
8	Jackfruit	Artocarpusheterophyllus Lam.	Moraceae
9	Breadfruit plant	Artocarpuschama	Moraceae
10	Neem Tree	Azadirachtaindica A. Juss	Meliaceae
11	Camel's foot tree	Bauhinia variegata L.	Caesalpiniaceae
12	Bishmarck plant	BishmarekianobilisHildebr. & H. Wendl	Aracaceae
13	Palmyra palm	Borassuaflabelliformis L.	Aracaceae
14	Golden shower	Cassia fistula L.	Caesalpiniaceae
15	Pink shower tree	Cassia nodossaBuch. Ham. Ex Roxb.	Caesalpiniaceae
16	Araca palm	Chrysalidocarpuslutescense H. Wendl	Aracaceae
17	Coconut tree	Coccosnucifera L.	Aracaceae
18	Sago palm	Cycas revolute Thunb.	Cycadaceae
19	Indian rosewood	Dalbergiasissoo	Fabaceae
20	Gulmohur	DelonixregiaBojr. Raf.	Caesalpiniaceae
21	Pongamoiltree	Derris indica	Fabaceae
22	Butterfly palm	DypsislutecensBeentje&Dransf	Aracaceae
23	Indian olive	Elaeocarpusfloribundus Bl., Bijdr.	Elaeocarpaceae
24	Monkey pod tree	Enterolobiumsaman	Fabaceae
25	Indian corel tree	ErythrinaindicaLamk.	Papilionaceae
26	Benjamin fig tree	Ficusbenjamina L.	Moraceae
27	Common fig plant	Ficushispida	Moraceae
28	Sacred fig	Ficusreligiosa	Moraceae
29	Silver oak	Grevillea robusta R. Br.	Proteaceae
30	Para rubber tree	HeveabrasilliensisMuell-Arg.	Moraceae
31	Thai crape myrtle	Lagerstroemia floribunda	Lythraceae
32	Litchi tree	Litchi chinensesSonnar	Sapindaceae
33	Litsea tree	Litseamonopetalal Roxb. Pers	Lauraceae

34	Mountain pepper	Litseacubeba	Lauraceae
35	Fasttech Fan Palm	Livistonachinensis	Aracaceae
36	Drum strick tree	MoringaoleiferaLamk.	Moringaceae
37	Pygmy date palm	Phoenix robelenii O' Brien	Aracaceae
38	Temple tree	Plumeria alba L.	Apocynaceae
39	False ashoka tree	PolyalthialongifoliaSonnerThw.	Annonaceae
40	Guava plant	Psidiumguajava L.	Myrtaceae
41	Needlewood tree	Schimawallichii	Theaceae
42	Jumbolan tree	Syzygiumcumini LSkecls.	Myrtaceae
43	Arjun tree	Terminaliaarjuna DC W. & A.	Combretaceae
44	Thuja plant	Thujaorientalis L.	Cupressaceae
45	Ber tree	ZiziphuszujubaLamk.	Rhamnaceae

List of Vertebrates

Mammals :

SL No.	Common name	Scientific name
1	Rhesus macaque	Macaca mulatta
2	Leopard cat	Prionailurus bengalensis
3	Jungle cat	Felis chaus affrinis
4	Grey Mongoose	Herpestes edwardsii
5	Small Indian Mongoose	Herpestes javanicus
6	Golden Jackal	Canis aureus
7	House shrew	Suncus marinus
8	White-tailed mole	Parascaptor leucura
9	Orange-bellied Himalayan Squirrel	Dremomys lokriah
10	Indian Flying Fox	Pteropus giganteus
11	Indian Leaf-nosed Bat	Hipposideros lankadiva

Birds :

SL No.	Common name	Scientific name
1	White-breasted waterhen	Amaurornis phoenicurus
2	Cattle egret	Bubulcus ibis
3	Little egret	Egretta garzetta
4	Great egret	Ardea alba
5	Indian pond heron	Ardeola grayii
6	Spotted dove	Spilopelia chinensis
7	Rose-ringed parakeet	Psittacula krameri
8	Common goldenback	Dinopium javanense
9	White-throated kingfisher	Halcyon smyrnensis
10	Lineated barbet	Megalaima lineata

11	Blue-throated barbet	Megalaima asiatica
12	Black kite	Milvus migrans
13	Brown fish owl	Ketupa zeylonensis
14	Eastern jungle crow	Corvus levaillantii
15	House crow	Corvus splendens
16	Asian koel	Eudynamys scolopaceus
17	Lesser coucal	Centropus bengalensis
18	Black drongo	Dicrurus macrocerus
19	Ashy drongo	Dicrurus leucophaeus
20	Ashy woodswallow	Artamus fuscus
21	Black-hooded oriole	Oriolus xanthornus
22	Common myna	Acridotheres tristis
23	Jungle myna	Acridotheres fuscus
24	Asian-pied starling	Gracupica contra
25	Chestnut-tailed starling	Sturnia malabarica
26	Red-vented bulbul	Pycnonotus cafer
27	Red-whiskered bulbul	Pycnonotus jocosus
28	Oriental-magpie robin	Copsychus saularis
29	White wagtail	Motacilla alba
30	Asian palm swift	Cypsiurus balasiensis
31	Indian roller	Coracias benghalensis
32	Green bee-eater	Merops orientalis
33	Chestnut-headed bee-eater	Merops leschenaulti
34	Purple sunbird	Cinnyris asiaticus
35	Great tit	Parus major
36	House sparrow	Passer domesticus
37	Eurasian tree sparrow	Passer montanus
38	White-rumped munia	Lonchura striata

Lizards :

Family	Scientific name		
Agamidae	1	Calotes versicolar	
6	2	Sitana ponticeriana	
Gekkonidae	3 Hemidactylus frenatus		
Scincidae	4	Sphenomorphus maculatus	
Scincidae	5	Eutropis multifasciata	
Varanidae	6	Varanus bengalensis	

Amphibia :

Family		Scientific Name
	1.	Ichthyophis garoensis
	2.	<u>Megophrys parva</u>
	3.	Duttaphrynus melanostictus
	4.	<u>Microhyla ornata</u>
	5.	<u>Chirixalus vittatus</u>
	6.	Philautus garo
	7.	Polypedates leucomystax
	8.	<u>Fejervarya teraiensis</u>
	9.	<u>Fejervarya nepalensis</u>
	10.	<u>Hylarana leptoglossa</u>
	11.	<u>Humerana humeralis</u>
	12.	Duttaphrynus melanostictus
	13.	Hoplobatrachus tigerina
	14.	Euphlyctes cyanophlyctes

Fishes :

Family	Common name		Scientific name
	Indian flying barb	1	Esomus danricus
Cvprinidae	Giant danio	2	Danio aequipinnatus
	Moustached danio	3	Danio dangila
	Zebrafish	4	Brachydanio rerio
	Mola carplet	5	Amblypharyngodon mola
	Common carp	6	Cyprinus carpio
	Copper mahseer	7	Neolissochilus hexagonolepis
	Labura	8	N. hexastichus
	Swamp barb	9	Puntius chola
	Shalyni barb	10	Puntius shalynius
Balitoridae	Gray's stone loach	11	Balitora brucei
	Mottled zipper loach	12	Acanthocobitis botia
Cobitidae	Queen Loach	13	Botia dario
	Guntea loach	14	Lepidocephalus guntea

List of Invertebrates

Spider :

Family		Scientific name
	1	Leucauge pondae
Tetragnathidae	2	Tetragnatha mandibulata
	3	Leucauge decorata
Thomisidae	4	Misumena vatia
	5	Camaricus formosus
	6	Amyciaea forticeps
Hersilidae	7	Hersilia savignyi
Nephilidae	8	Nephila pilipes
-	9	Herennia multipuncta
Araenidae	10	Gastercantha kuhli
	11	Cyrtophora feai
	12	Neoscona nautica
	13	Gasteracantha dalyi
	14	Neoscona mukerjei
Ovvonidaa	15	Oxyopes rufisternum
Oxyopidae	16	Oxyopes shweta
Salticidae	17	Scytodes thoracica
Lyaqqidaq	18	Hippasa sp
Lycocidae	19	Lycosa mackenziei
Theraphosidae	20	Morphospecies sp.
Theridiidae	21	Chrysso pulcherrima
	22	Chrysso nigra

Moths :

Family		Species	Scientific name
Arotiidaa	1	Tiger moth	Asura sp.
Alculuae	2	Marble white moth	Nyctemera adversata
	3	Beet web worm moth	Spoladea recurvalis
	4	Rice leaf folder Cnaphalocrocis medinal	
	5	Yellow Peach Moth	Conogethes punctiferalis
Crambidaa	6	Grass moth	Endocrossis flavibasalis
Cramoluae	7	Crambid moth	Glyphodes canthusalis
	8	Mung Bean moth	Marucavitrata
	9	Rice caseworm	Parapoynx stagnalis
	10	Grass moth	Botyodes asialis
Erebidae	11	Snouted Tiger moth	Asota caricae

	12	Tussock Moth	Lymnantria dispar	
	13	True loopers	Eucyclodes sp.	
Gaamatridaa	14	Loopers moth	Ruttellerona pallicostaria	
Geometridae	15	True loopers	Scopula sp.	
	16	Geometrid Moth	Eucyclodes divapala	
Hyblaeidae	17	Teak defoliator moth	Hyblaeapuera	
Noctuidae	18	Owlet Moth	Gramodes geometrica	
Nolidae	19	Borer	Beana terminigera	
Pyralidae	20	Snout Moth	Pyralis farinalis	
Sphingidae	21	Tiger Hawk Moth	Hippotion sp.	
Thyrididae	22	Sapodilla Borer	Banisia myrsusalis	

Butterfly diversity :

Family	Scientific name		IUCN status
	1	Baoris farri	Not rare
	2	Barbo bevani	
	3	Caltoris kumara	
	4	Caltoris philippina	
	5	Caltoris plebeia	
	6	Caprona ransonnetti	
	7	Cephrenes acalle	
	8	Cupitha Purreea	Not rare
	9	Halpe homolea	
	10	Lambrix salsala	Common
Hesperiidae	11	Notocrypta curvifascia	Common
	12	Oriens gola	Not rare
	13	Parnara bada	
	14	Parnara guttata	Common
	15	Pelopidas mathias	Common
	16	Pseudocoladenia dan	Common
	17	Psolos fuligo	Common
	18	Saranga dasahara	Common
	19	Suastus gremius	
	20	Tagiades japetus	Common
	21	Udaspes folus	Common
	22	Amblypodia anita	
Lycaenidae	23	Anthene emolus	Common
	24	Arhopala atrax	
	25	Arhopala centaurus	Not rare

	26	Caleta caleta	
	27	Castalius rosimon	Common
	28	Heliphorous epicles	Common
	29	Hypolycaena erylus	Common
	30	Ionolyte helicon	
	31	Jamides bochus	Common
	32	Lampides boeticus	Common
	33	Loxura atymnus	Common
	34	Nacaduba hermus	Not rare
	35	Prosotas nora	Common
	36	Pseudozizeeria core	
	37	Pseudozizeeria maha	Very common
	38	Virachola isocrates	
	39	Zeltus amasa	Not rare
	40	Zinaspa todara	
	41	Zizeeria karsandra	Common
	42	Zizina otis	Common
	43	Ariadne areadne	Common
	44	Athyma inara	Not rare
	45	Athyma perius	Common
	46	Athyma ranga	Rare
	47	Cethosia cyane	Not rare
	48	Charaxes agrarius	
	49	Cirrochroa aoris	Not rare
	50	Cynitia lepidea	Common
	51	Cyrestis thyodamas	Common
	52	Danaus crysippus	Very common
Nymphalidae	53	Elymnias caudata	
	54	Elymnias hypermnestra	Common
	55	Elymnias malclas	
	56	Euploea core	Common
	57	Euploea sylvester	
	58	Euthalia aconthea	Not rare
	59	Euthalia lubentina	
	60	Hypolimnas bolina	
	61	Junonia almana	Common
	62	Junonia atlites	Not rare
	63	Junonia hierta	Common
	64	Junonia iphita	Common
	65	Junonia lemonias	Common
	66	Kaniska canace	
	67	Lebadea martha	Not rare

	68	Lethe confusa gambara	
	69	Melanitis	Common
	70	Melanitis leda	Very common
	71	Melanitis phedima	Common
	72	Melanitis zitenius	Not rare
	73	Mycalesis mineus	Very common
	74	Mycalesis perseus	very common
	75	Mycalesis sp.	Common
	76	Neptis clinia	Rare
	77	Neptis hylus	very common
	78	Neptis nata	Rare
	79	Orsotriaena medus	Common
	80	Pantoporia hordonia	Common
	81	Phalanta phalantha	Common
	82	Symbrenthia lilaea	Common
	83	Tanaecia lepidea	Not rare
	84	Tirumala limniace	Very common
	85	vagrans egista	Not rare
	86	Vindula erota	Not rare
	87	Ypthima baldus	Very common
	88	Ypthima striata	
	89	Ypthima tabella	
	90	Graphium sarpedon	
	91	Papilio castor	Not rare
Papilionidae	92	Papilio demoleus	Very common
	93	Papilio helenus	Common
	94	Papilio polytes romulus	Very common
	95	Appias albina	Rare
	96	Appias libythea	Rare
	97	Appias lyncida	Common
	98	catopsilia pomona	Common
	99	Catopsilia pyranthe	Common
Diaridaa	100	Delias pasithoe	Not rare
Tiendae	101	Eurema andersonii	Rare
	102	Eurema balanda	Common
	103	Eurema hecabe	very common
	104	Gandaca harina	?
	105	Leptosia nina	Common
	106	Pieris canidia	Very common
Riodinidae	107	Abisara bifasciata suffusa	Not rare
	108	Zemerous flegyas	Very common

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Grasshopper

Family		Scientific name
	1	Oxya yezonsis
	2	Oxya hylahyla
	3	Oxya chinensis
	4	Phlaeoba infumata
	5	Trimerotropis pallidipennis
	6	Trilophidia annulata
	7	Spathosternum prasiniferum
	8	Concephalus semivittatus
	9	Concephalus nigropleurum
	10	Hexacentrus unicolor
	11	Euconocephalus pallidus
	12	Atractomorpha crenulata
	13	Atractomorpha similis
	14	Tetrix subulata

Zooplankton

Types		Scientific name
	1	Centropyxis
	2	Dinobryon
	3	Difflugia
Protozoans	4	Eudorina
	5	Euglypha
	6	Pandorina
	7	Vorticella
	8	Brachionus
	9	Asplanchna
	10	Chromogaster
	11	Euchlanis
	12	Filinia
	13	Hexarthra
	14	Keratella
	15	Lecane
	16	Mytilina
Í	17	Monostyla
	18	Polyarthra
[19	Rotatoria
	20	Synchaeta
Rotifera	21	Trichocera
Copepods	22	Alonella
	23	Bosmina
	24	Canthocampus
	25	Chydorus
	26	Daphnia
	27	Moinasida
	28	Simocephalus
	29	Diaphanosoma

ENERGY AND ELECTRICITY:

Energy and electricity audit covers the aggregate consumption of power on the campus. It covers consumption of natural gas and fuels (diesel) in the different academic and administrative blocks, shopping complex, hostels and auditorium. It tries to decipher if renewable energy sources like solar energy facilities are available on the campus. Moreover, since LED lights are more environmentally sustainable than CFLs and fluorescent bulbs, the audit evaluates the percentages of CFL, LED (bulb and tube light) and fluorescent (bulb and tube light) used on the campus.

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

The month wise unit consumption in the campus during 2018 and 2019 is shown in

Figure 1; In aggregate, the average monthly power consumption in the campus in 2018 was 52899 KVAH while in 2019 it is found to be 46172 KVAH.



Figure 2; implying that there is a reduction in average monthly power consumption by 23 %.

Figure 1: Month wise unit consumption in 2018 & 2019



Figure 2: Average monthly power consumption in 2018 & 2019

The survey finds that:

- On average, the Administration block of the University has 15 % LED Tube light & Bulb, 74% of CFL light, 11% of fluorescent tube light.
- On average, the Academic blocks of the University has 32 % LED tube light, 11% of LED bulb, 44% of CFL light, 13% of fluorescent tube light and no incandescent& fluorescent bulb.

Solar Lighting:

The University also has standalone solar street light facility. It has 50 nos. of 12 Watt, 10 nos. of 15 Watt and 6 nos. of 30 Watt solar street lights. Recently, the University has also installed its own solar generating plant in the campus with a generation capacity of 5.2 kW of power. The University has also future plans of expanding this generation capacity by installing more solar plants.

An energy saving potential of **0.802 MU** per annum was observed, which is summarized as below. It has been found an energy saving potential of about 23%.

- 1. Retrofitting of 40W fluorescent tube lights with conventional ballast with 18W LED tubes can save **12878.4 kWh** per year and financial saving of **Rs. 1,21,057.**
- **2.** 60W fan regulator can be replaced with new and energy saving efficient electric regulator which saves **7770 kWh** per year and financial saving of **Rs. 73,038.**
- **3**. Retrofitting old & inefficient split type AC with 5 star AC. The expected energy saving potential is **10754 kWh** per year and financial saving of **Rs. 1,01,088**

4. The monthly maximum (MD) recorded during January 2019 to December 2019, ranges from 139 kVA to 168 kVA. But, the contract demand is 130 kVA. As per the tariff regulation, the consumer has to pay the extra demand charges of more than Rs. 150 per kVA.

RECOMMENDATIONS

The following recommendations are made for short and medium term implementations.

- To put in place a comprehensive waste disposal system. The system in place should be displayed in strategic positions to keep everybody aware.
- 2. Installation of separate, dustbins in a few locations to encourage segregation of wastes and separately collect the biodegradable and new biodegradation wastes.
- 3. In-house documentation and analysis of air, water and noise in the campus with validation by NABL accredited laboratory should be made at regular interval.
- 4. Installation of electric and water meters in all administration units, academic departments and hostels should be carried out.
- 5. In order to promote diversity, systematic plantations should be carried out in the campus emphasising on indigenous species.
- 6. Creation of "Green Fund" with individual and institutional contribution.
- 7. Awareness programme should be carried out at periodic intervals to ensure plastic free campus.
- 8. Replacement of CFL and other fluorescent lights with LED during next one year.
- 9. Expansion of generation of solar power should be up to 500 kW in next three years.

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