GREEN, ENERGY AND ENVIRONMENT AUDIT REPORT

2020-21

NOWGONG GIRLS' COLLEGE, NAGAON, ASSAM

Submitted by: Nowgong Girls' College

Nagaon, Assam

Submitted to: National Assessment and Accreditation Council (NAAC)

Certificate

This is to certify that Green, Energy and Environment Audit on various aspects for maintaining a sustainable environment was carried out at Nowgong Girls' College Campus as a part of green campus initiative. It has been observed that the college is maintaining an eco-friendly ambience for students, faculties and other stakeholders.

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PREFACE

Energy and environmental auditing also known as green auditing is a way of evaluating the effects an Institution has caused on the environment. It is a tool to identify and assess the environmental practices in and around the college campus, which have an impact on eco-friendly ambience. The college has adopted Green campus initiatives to determine the utilization of energy, resources and water. The objective of this green audit is to reduce pollution, managing natural resources of the campus in a sustainable way and creating an eco-friendly ambience for students, faculties and other members of the college fraternity. The Green Audit Report (2020-21) of Nowgong Girls' College is a cumulative work of Botany, Zoology, Geography, Chemistry, Physics, Statistics and Mathematics department where all the faculties and students have participated actively in this noble initiative for clean and green campus.

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1. Introduction

1.1 . Brief Profile of Nowgong Girls' College:

The need for a dedicated institution of higher education exclusively for women in the central Assam region was felt during the late 1950's. In order to fill that void, several eminent personalities and educationists came together to establish the 'Nowgong Women's College' in 1959. Dr. Lalit Kr. Baruah was the founder secretary and Professor Nirmal Chandra Samaddar of Nowgong College served as the acting Principal of the institution. However, owing to the demise of Dr. Lalit Kr. Baruah in June, 1960 the institution ceased to exist. However, the spark of opening a women's college was still in the heart of many people and accordingly in June 1962 a formal discussion to establish such an institution was held in the Office of the Deputy Commissioner of Nowgong. In this meeting a Steering Committee was formed for the said purpose. On 8th July 1962, some members of the Steering Committee met the then Education Minister of Assam Debakanta Baruah for establishing a women's college in Nowgong. The first meeting of the Steering Committee was held on 11th July 1962 in the Deputy Commissioner's office, chaired by the then Deputy Commissioner of Nowgong Satish Jivan Das, IAS. The Committee decided to start Pre-University and Degree courses simultaneously in the College. The Committee decided to name the college as Nowgong Women's College.

Nowgong Girls' College is a premiere institution of higher education for women in central Assam. It has been continuing its glorious journey since 12th September 1962. Established as Nowgong Women's College, this institution was later named as Lal Chand Todi Girls' College and finally in 1968 it was renamed as Nowgong Girls' College. It has travelled a long way imparting higher education to the aspiring girl students of Nagaon and adjoining districts. The college is affiliated to Gauhati University and is included under section 2(f) of the UGC Act, 1956. The college owes its existence to the inspired pioneering works and foresightedness of its prime mover and guiding spirit Late Mahesh Chandra Dev Goswami (1917-1989), the founder principal and eminent educationist of Assam. The college is accredited with 'A' Grade by NAAC, UGC.

The College is situated at the right bank of river Kolong with a total area of 25,440 Sq. m. The campus is fragmented into four parts with an area of 12,731, 4775, 1431 and

6503. The main campus area of the college is characterized by almost even topography with an average elevation of 58 meter from mean Sea Level. The Campus is characterized by numbers of floral and faunal diversity of species.

The college has 18 UG and 2 PG Departments, Computer courses, self-sponsored courses and KKHSOU study centre. For the session of 2020-21 a total of 1849 students enrolled for UG and PG Courses. There are 5 buildings in the college campus with more than 40 classrooms with necessary requirements and proper laboratory facilities in the Departments of Botany, Chemistry, Physics, Zoology, Education, Geography and Mathematics. The Library of the college (Mahesh Chandra Dev Goswami Library) have 2 numbers of Halls with more than 46 thousand books. The Administrative office consist of 5 spacious rooms with all necessary facilities and technology including internet. A total of 5 numbers of Digital Seminar/Conference Halls with all necessary facilities for conduction of different activities of the college and the departments. The college have one Auditorium with Centralized Air Conditioning facility with two green rooms and one Open Stage for big functions. One Canteen in the campus for providing tea, snacks and lunch. There are 2 numbers of Girl's Hostel (Padmawati Devi Phookani Hostel and Swahid Bhogeswari Phookani Hostel) with above 200 capacity and facilities like canteen, T.V., study room, library is present. Indoor Stadium covers badminton facility with 2 numbers of rooms and a balcony. One Book Stall is also present inside the campus.

Figure 1: Front view of Nowgong Girls' College

Figure 2: A satellite image showing Nowgong Girls' College Campus (20/09/2020)

1.2. Objectives:

- To ensure campus development along with protecting the environment.
- To educate the students about the necessity of environmentally friendly approach in life.
- Sustainable use of energy.
- To ensure installation of devices that reduce pollution and energy consumption.
- To ensure optimum utilization of resources.
- To improve the environment condition in and around the college campus.
- To monitor water quality assessment and also minimise the consumption of water.
- To ensure eco- friendly disposal of all types of waste.
- To ensure compliance with present legislation of the nation, state and other legal authorities.
- Identification of gaps and suggest recommendation for improvement in the college environment.

1.3. Importance of Green Audit

A green audit is a good way to measure an organisation's environmental impacts, and enables to take informed decisions for managing these impacts.

The importance of the green audit include:

- Reducing environmental impacts by:
    - Tree plantation
    - Making possible arrangements for habitats for different life forms terrestrial, aquatic and aerial
- Reducing waste, water and energy costs.
- To verify compliance with environment laws.
- Providing information to identify needs, strengths and weaknesses of the institute.
- Providing a starting point for environmental management.
- It would be helpful for making the college more environment friendly.
- Enhance the alertness for environmental guidelines and duties.
- Demonstrate institutes' commitment to environmental protection to students, employees and public.

2. Methodology:

The purpose of the green audit of the College is to ensure that the practices in accordance with the environmental protection is followed in the campus. The methodology includes physical inspection of the sites related to the audit, collection of data required for the audit and analysis of the collected data and documents. So, the methodology adopted for this audit can be subdivided into three major steps:

i. **Data Collection** – In this phase, exhaustive data collection was carried out using different tools and techniques like observation, survey, communicating with responsible persons and measurements. Steps followed for data collection include:
    - Team comprising of faculty, students and staff members (based on the type of data to be collected) visited each department, centre, library, hostel, canteen etc.
    - General information data was collected by observation and interview.
    - The power consumption of electrical appliances was recorded and averaged out for the given period of the audit
    - Workshops, talks etc. were conducted to train the designated teams for identification and data collection on biodiversity in the campus

ii. **Data Analysis** – The collected data were carefully analysed and the process includes the steps like:

- Calculation of energy consumption and analysis of electricity bills of the campus
- Analysis of data related to water usages, waste management etc. using appropriatemethodology,
- use of different computer-based tools like GIS, software like excel, origin etc. are for data analysis

iii. **Recommendation** – Based on the results of data analysis and observations, some steps for biodiversity conservation, reducing power and water consumption, roper treatment of different waste material and other related activities for environmental protection were recommended.

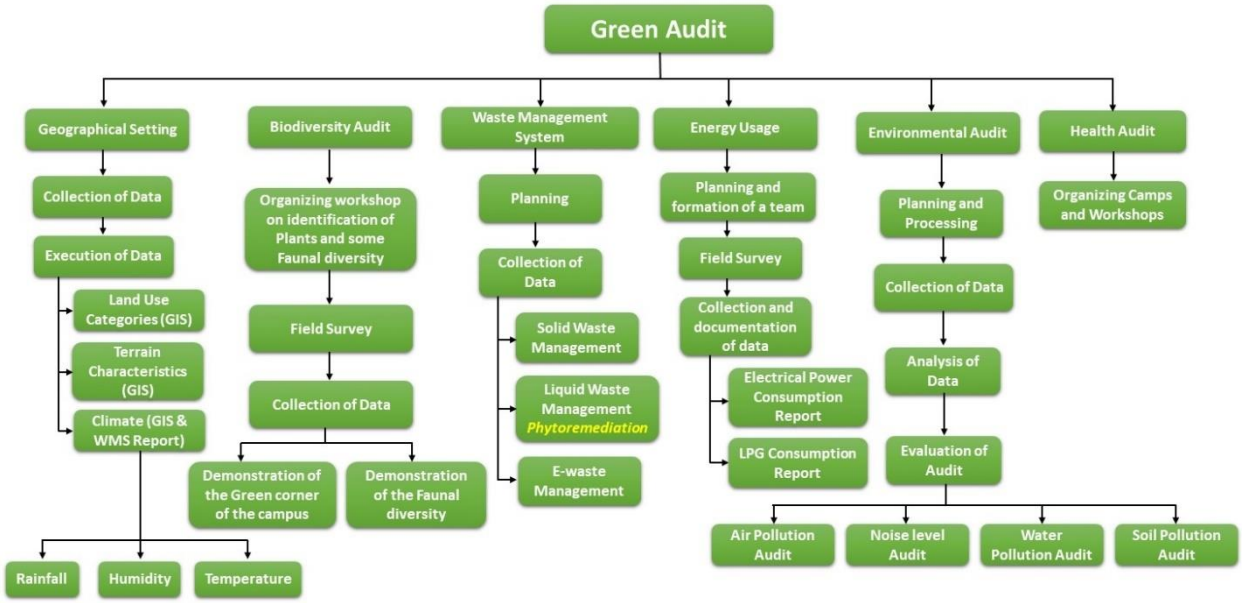


Figure 3: A diagrammatic representation of different components of the Green Audit

3. Geographical Settings of Nowgong Girls' College

3.1. Land-Use Categories

The college campus is characterised by mosaic of different land use categories. The built-up environment of this college is characterised by different categories of Buildings with respect to various departments, several constructions as well as land covers including trees and vegetation, ponds etc. which gives diverse ecosystem for the domicile of flora and fauna inside the campus. A general survey was conducted using both traditional survey and

cartographic method and GPS surveying methods in 2020, which shows that a total of 25,440 sq. meters of land in the main college campus with 23 nos. of land use and landcover classes. The vegetation cover of the campus is characterized by various sub-tropical and evergreen trees. The overall land use and land cover categories are shown in Table 1.

Table 1: Land use categories in Nowgong Girls' College Campus (Based on survey 2020)

Sl. No.	Land Use category	Area (Sq. meters)
1.	Administrative Block and Science Block B	635
2.	Girls' Hostel (SBP)	948
3.	Arts Block	1603
4.	Auditorium	537
5.	Menial Quarter 1	99.3
6.	Canteen	371
7.	Digital Seminar Hall	100
8.	Foot Over Bridge	74.5
9.	Girls' Hostel (PDP)	1369
10.	Indoor Stadium	681
11.	Menial Quarter 2	119
12.	Menial Quarter 3	119
13.	KKHSOU Study Centre and Post Office	152
14.	Kolong River	13,436
15.	Dept. of Physics	852
16.	Open Space	4762
17.	Open Stage	155
18.	Playground	1506
19.	Science Block A	350
20.	Martyrs Memorial and Fountain	116
21.	Hoarding Structure	115
22.	River Bank	2825
23.	Vegetation	7951.2
24.	College Campus	25,440

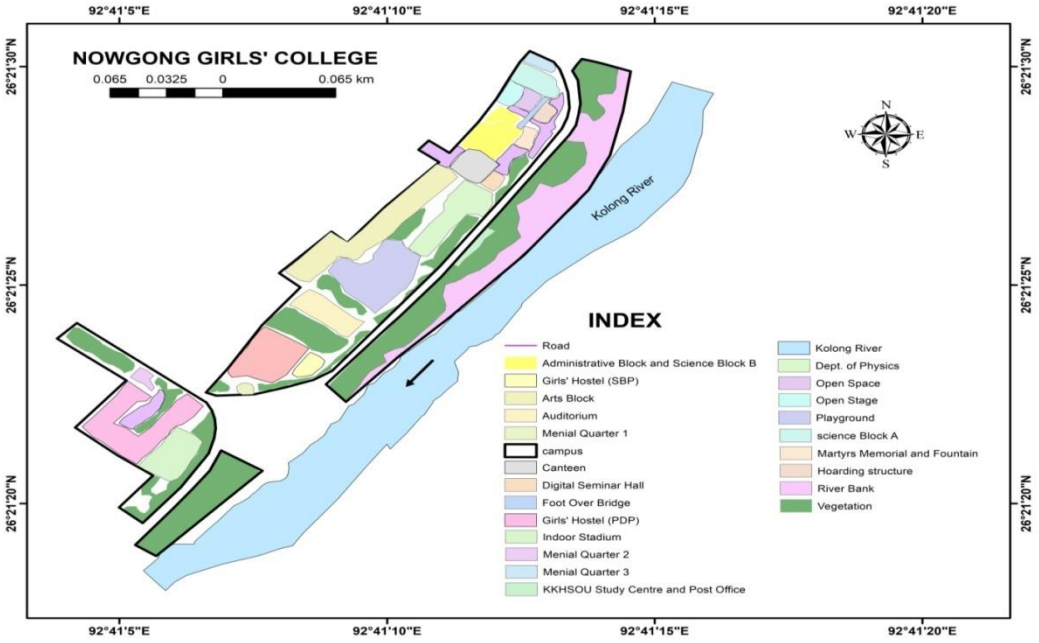


Figure 4: Land use categories of Nowgong Girls' College

3.2. Terrain Characteristics

For the evaluation of general terrain condition of Nowgong Girls' College a GPS based study has been conducted by the Department of Geography. The location and elevation data are generated throughout the four campus using GPS devices. After the collection of the elevation data a Digital Elevation Model is generated using GIS software. The IDW (Inverse distance weighting) method is applied while preparing the map. After the creation of the specified DEM a contour map is also generated that gives an overall idea of the terrain as a plain area. As we get only two contours with an interval of one. There is also a slight difference of only 3.12 metres in and around the campus. Hence, we can assume that the campus is situated in a fairly uniform topography.

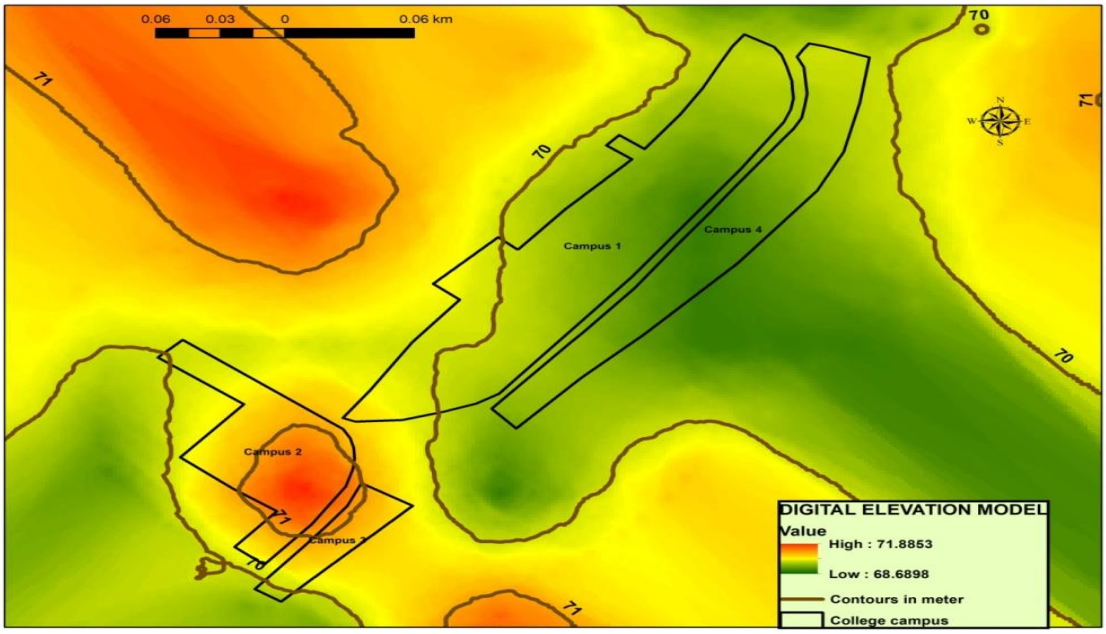


Figure 5: Digital Elevation Model based on GPS survey

A slope map is also prepared based on the created Digital Elevation Model. As the overall terrain condition is uniform, there is no such huge variation of slopes within the area.

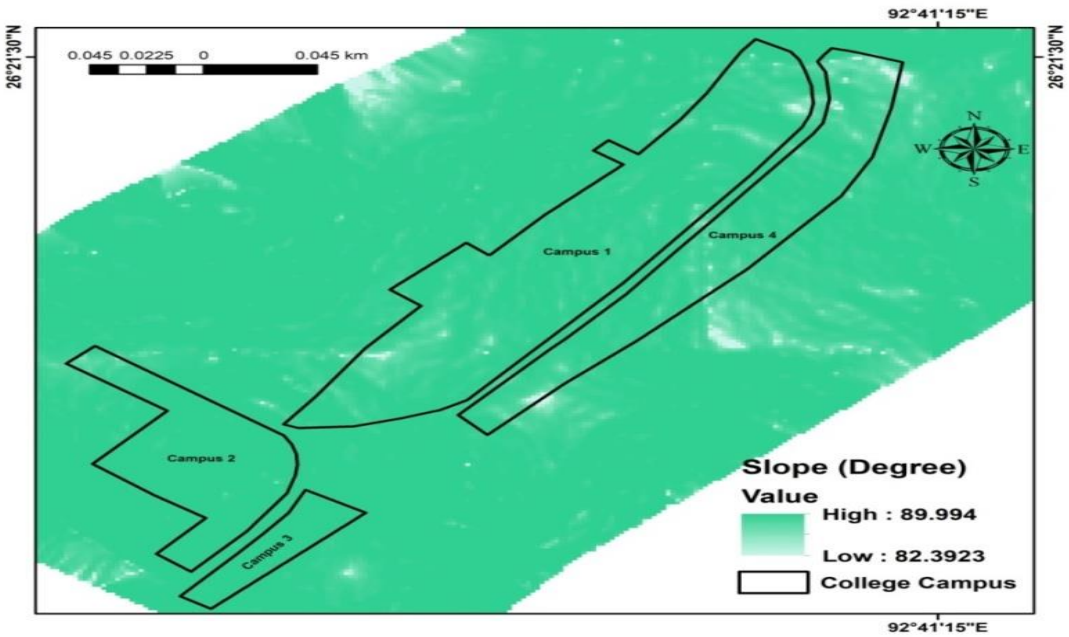


Figure 6: Slope map of College Campus

3.3. Climate

The college campus witnesses the same climatic characteristics similar to the Brahmaputra valley. The regional climate of Assam is controlled by the seasonality of monsoon winds with diverse physiographic settings. In monsoon months the region experiences heavy shower of thunderstorms. It experiences cool dry winter and hot and humid summer. The temperature and rainfall raster are downloaded from worldclim website and integrated in GIS software to produce the map. The temperature map shows an average annual temperature of 24.38^{o}C. A rainfall raster map is generated using GIS software's gives us an average value of 139 mm of rainfall in and around the campus. Apart from that the temperature data is collected in the college campus and highest temperatures recorded between 12 to 4 p.m. The maximum temperature varies from 29 to 31^{o}C in June, July and August.

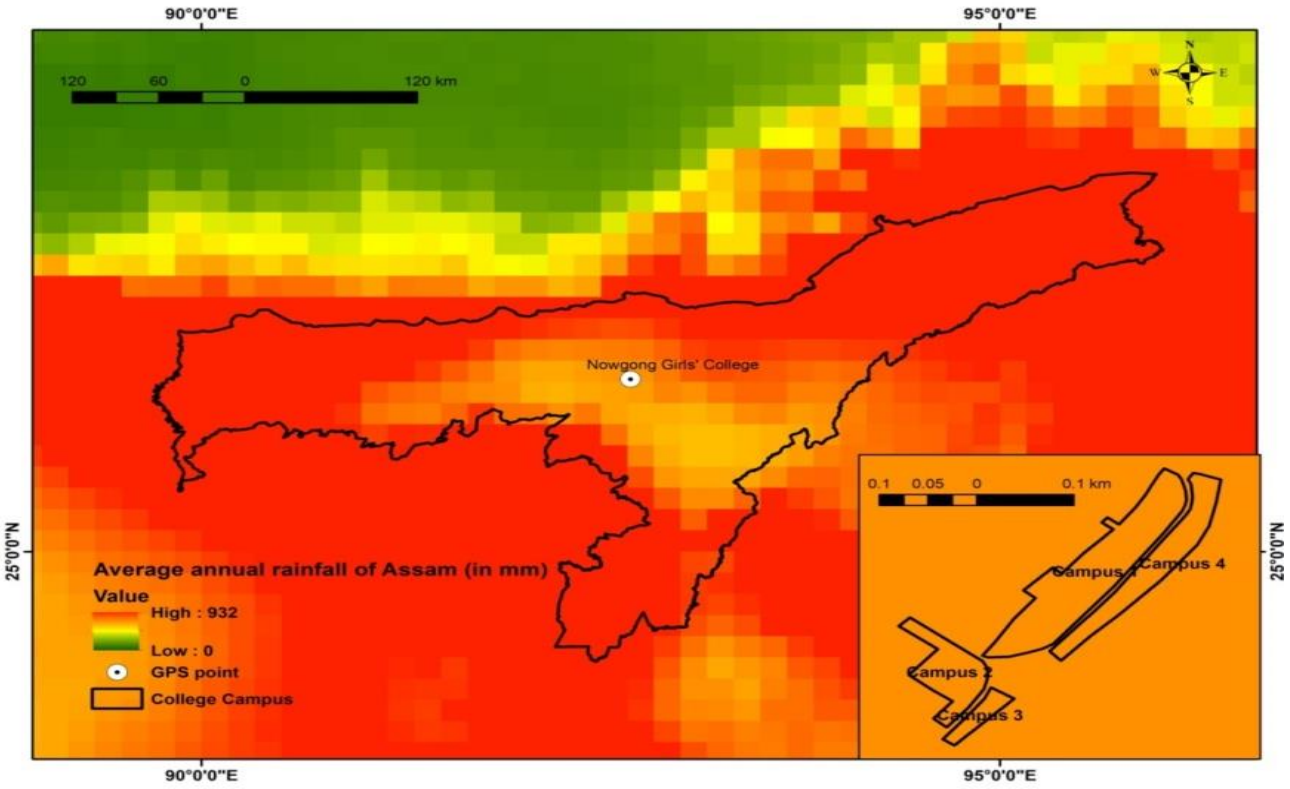


Figure 7: Average Annual Rainfall

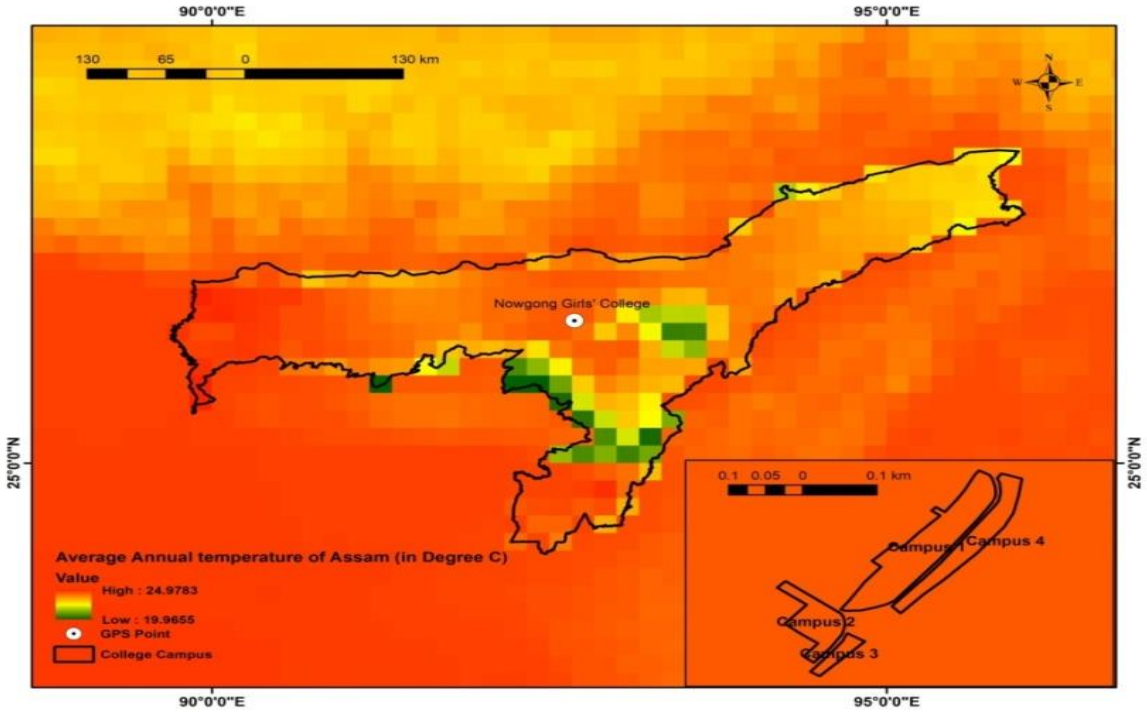


Figure 8: Average Annual Temperature

A hygrometer is used to record the relative humidity of the College campus. The average annual humidity for the year 2016 to 2021 are 80, 81, 77, 80, 81 and 79 % respectively. The overall humidity for the months of November to February is low that signify a dry weather.

Figure 9: Weather Monitoring Station

	Years	
Months	**2020**	**2021**
January	84	75
February	75	71
March	70	61
April	79	77
May	83	84
June	84	88
July	88	81
August	82	88
September	87	86
October	84	80
November	79	77
December	76	83
Average	80.92	79.25

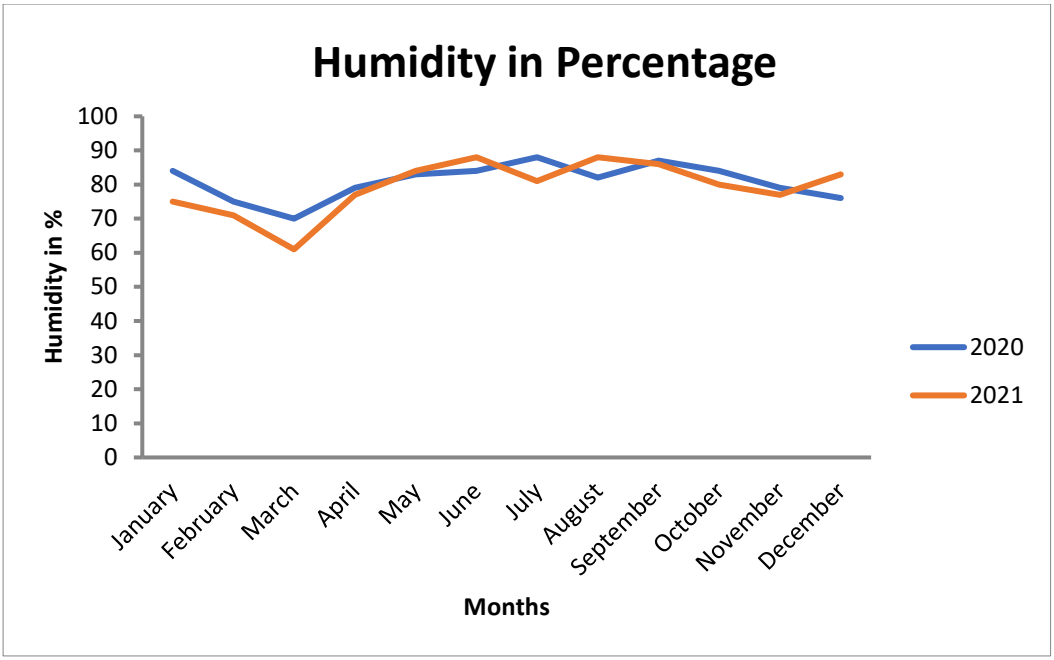


Figure 10: Humidity in percentage for Nowgong Girls' College

4. Biodiversity Audit of Nowgong Girls' College

Biodiversity is an elaborate term used to describe the enormous diversity of floral, faunal and microbial species on earth. It has been estimated that there are around 8.7 million species of plants and animals in existence. According to United Nation General Assembly officially adopted the resolution declaring 2021-2030 as "The UN Decade of Ecosystem Restoration" aimed at immense restoration of the degraded ecosystem as a proven measure to fight the climate crisis, biodiversity and water supply. Biodiversity provides a variety of environmental services, the production of oxygen, reduction of carbon-dioxide, balancing the water cycle, best air purifier and protection of water resources, contribution to climate stability and maintenance of ecosystems and also helps in controlling soil, water and air pollution. However, maximum of earth's biodiversity is in threatened condition due to natural calamities and human interference. These threats have caused an unprecedented rise in the rate of species extinction. The replacement of these extremely important services from the biodiversity would be extensively expensive, therefore, sustainability can lead towards enhancing the greenery, minimising the global warming and economic development.

A Biodiversity richness map is prepared using GIS which shows the distribution of richness within the campus.

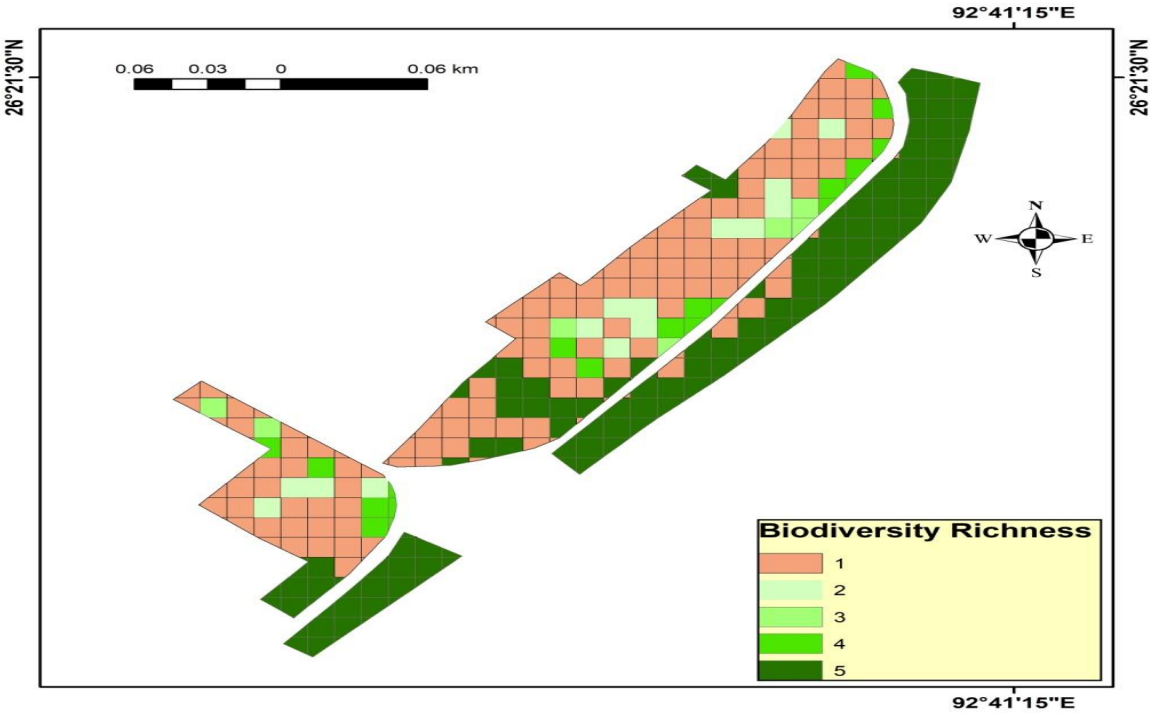


Figure 11: Biodiversity Richness Map of the College Campus

4.1. Greenery of the Campus

Over the last 5 years, there have been various plantation programmes carried out by the college under the initiative of teachers and students within the college as well as in the nearby locality and in the adopted village (Itapara) as an effort to promote the greenery within and outside the campus. Having been in the banks of the river, the area is bestowed with a wide diversity of flora and fauna. The Green Audit Committee of Nowgong Girls' College also aimed at planting indigenous trees supported by the local people. Plants house a number of insects and birds. The thick belt of large shady trees around the college periphery gives an overall idea of the rich glorious history of the college. The college campus also holds a garden having numerous seasonal flowers with vibrant colours that adds to the aesthetic beauty to the college. The college campus is enriched with a huge variety of plant species from herbs, shrubs, trees, climbers, epiphytes including a number of aquatic plant species as well. The college has started a novel venture of cultivation of vegetables and fruits in an area of the campus as a means of land utilisation. Kitchen garden was encouraged through college activity which also added a bonus to the plant diversity of the campus. In addition, a medicinal plant garden is going to be maintained in the campus which will accommodate many medicinally important herbs and shrubs used in traditional medicines.

Aloe vera

Centella asiatica

Polyalthia longifolia

Ficus racemosa

Aerides rosea *Cymbidium aloifolium* *Rhynchostylis retusa*

Figure 12: Some plants of Nowgong Girls' College

A recent study has revealed that the rich diversity of plant species of about 196 species (57 herbs, 26 shrubs, 36 trees, 09 climbers, 09 aquatic plants, 07 epiphytes, 30 seasonal flowers and ornamental plants and 22 seasonal vegetables) belonging to various families. The following are the plant species abundant in the campus.

Table 2: List of Herbs

Sl. No.	Scientific name of plants	Family	Common names
1.	*Achyranthus aspera* L.	Amaranthaceae	Prickly Chaff Flower
2.	*Ageratum conyzoides*(L.) L.	Compositae	Goat weed
3.	*Aloe vera* (L.) Burm. f.	Xanthorrhaeceae	Aloe vera
4.	*Alternanthera philoxeroides*(Mart.) Griseb.	Amaranthaceae	Alligator weed
5.	*Alternanthera sessilis*(L.) R. Br. Ex DC	Amaranthaceae	Stalkless Joyweed
6.	*Amaranthus spinosus*L.	Amaranthaceae	Prickly Amaranth

7.	*Amaranthus viridis*L.	Amaranthaceae	Green Amaranth
8.	*Argemone mexicana*L.	Papaveraceae	Mexican Prickly Poppy
9.	*Athyrium filix-femina*(L.) Roth	Athyriaceae	Lady Fern
10.	*Basella alba* L.	Basellaceae	Malabar Spinach
11.	*Bidens pilosa*L.	Compositae	Beggar Tick
12.	*Boerhaviadiffusa*L.	Nyctaginaceae	Red Spiderling
13.	*Brassica juncea*(L.) Czern	Brassicaceae	Mustard
14.	*Bryophyllumpinnatum*(Lam.) Oken	Crassulaceae	Cathedral bells
15.	*Canna indica* L.	Cannaceae	Indian Shot
16.	*Centella asiatica* (L.) Urb.	Apiaceae	Indian Pennywort
17.	*Cheilocostusspeciosus*J. (Koenig) C.D. Specht.	Costaceae	Crepe Ginger
18.	*Clerodendruminfortunatum*L.	Lamiaceae	Hill Glory Bower
19.	*Codiaeum variegatum* (L.) Rumph. Ex. A. Juss	Euphorbiaceae	Croton
20.	*Curcuma amada*Roxb.	Zingiberaceae	Mango Ginger
21.	*Cyanthilium cinereum* (L.) H. Roxb.	Compositae	Little Ironweed
22.	*Cynodondactylon* (L.) Pers.	Poaceae	Bermuda Grass
23.	*Cyprus rotundus*L.	Poaceae	Nut Grass
24.	*Drymaria cordata* (L.) Willd. Ex Schultz	Caryophyllaceae	Tropical Chickweed
25.	*Ecliptaprostrata*(L.) L.	Compositae	False Daisy
26.	*Eryngium foetidium*L.	Apiaceae	Long Coriander
27.	*Euphorbia hirta*L.	Euphorbiaceae	Asthma weed
28.	*Houttuyunia cordata* Thunb.	Sauraceae	Chameleon Plant
29.	*Hydrocotyle sibthorpioides* Lam.	Araliaceae	Water Pennywort
30.	*Hypoestes phyllostachya* Baker	Acanthaceae	Polka Dot Plant
31.	*Impatiens balsamina*L.	Balsaminaceae	Garden Balsam
32.	*Justicia adhatoda* L.	Acanthaceae	Malabar Nut
33.	*Leonurus sibicus*L.	Lamiaceae	Honeyweed

34.	*Leucas aspera* (Willd.) Link	Lamiaceae	Common Leucas
35.	*Matteuccia struthiopteris*(L.) Tod.	Onocleaceae	Fiddlehead
36.	*Mazus pumilus*(Burm.f.) Steenis	Phrymaceae	Asian Mazus
37.	*Mentha arvensis* L.	Lamiaceae	Mint
38.	*Mentha spicata* L.	Lamiaceae	Spearmint
39.	*Mimosa pudica*L.	Leguminosae	Touch-me-not
40.	*Mirabilis jalapa* L.	Nyctaginaceae	Four O'clock
41.	*Oxalis corniculata*L.	Oxalidaceae	Creeping Weed Sorrel
42.	*Oxalis debilis* Kunth.	Oxalidaceae	Large-Flowered Pink Sorrel
43.	*Peperomia pellucida* L. Kunth	Piperaceae	Shiny Bush
44.	*Phyllanthus fraternus*G.L. Webster	Phyllanthaceae	Gulf Leaf Flower
45.	*Pogostemon benghalensis* (Burm.f.) Kuntze	Lamiaceae	Bengal Pogostemon
46.	*Puzolzia zeylanica*	Urticaceae	Graceful Pouzolz's Bush
47.	*Rauvolfia serpentina* (L.) Benth. Ex.Kurz	Apocynaceae	Indian Snakeroot
48.	*Ricinus communis* L.	Apocynaceae	Castor Bean Plant
49.	*Sauropusandrogynus*L. Merr.	Phyllanthaceae	Sweet Leaf Bush
50.	*Scoparia dulcis* L.	Plantaginaceae	Sweet Broom Weed
51.	*Scutellaria indica* L.	Lamiaceae	Bicolor Skullcap
52.	*Solanum nigrum* L.	Solanaceae	Black Nightshade
53.	*Sonchus arvensis* L.	Compositae	Sow Thistle
54.	*Spilanthesacmella*(L.) L.	Compositae	Toothache Plant
55.	*Tradescantia pallida* (Rose) D.R. Hunt	Commelinaceae	Purple Heart
56.	*Urtica ardens*Link.	Urticaceae	Himalayan Nettle
57.	*Zingiber officinale* Roscoe	Zingiberaceae	Ginger

Table 3: List of Shrubs

Sl. No.	Scientific name of plants	Family	Common name
58.	*Calotropis gigantea* (L.) Dryand.	Apocynaceae	Milkweed
59.	*Carissa carandas* L.	Apocynaceae	Karanda
60.	*Celosia argentea* L.	Amaranthaceae	Plumed cockscomb
61.	*Celosia critata* L.	Amaranthaceae	Cockscomb
62.	*Clerodendrum indicum* (L.) Kuntz.	Lamiaceae	Tube-flower
63.	*Codiaeum variegatum* (L.) Rumph. Ex. A. Juss	Euphorbiaceae	Croton
64.	*Coffea benghalensis*B. Heyne ex Schult.	Rubiaceae	Bengal coffee
65.	*Cyperus scariosus*R.Br.	Cyperaceae	Nutgrass
66.	*Datura stramonium* L.	Solanaceae	Jimsonweed
67.	*Euphorbia milii*Des. Moul.	Euphorbiaceae	Christ plant
68.	*Gardenia jasminoides*J. Ellis	Rubiaceae	Cape jasmine
69.	*Hibiscus rosa-sinensis* L.	Malvaceae	Chinese hibiscus
70.	*Hibiscus sabdariffa* L.	Malvaceae	Roselle
71.	*Hydrangea quercifolia*W. Bartram.	Hydrangeaceae	Oakleaf hydrangea
72.	*Jasminum grandifolia*L.	Oleaceae	Spanish jasmine
73.	*Justicia adhatoda*L.	Acanthaceae	Malabar Nut
74.	*Lantana camara* L.	Verbenaceae	Spanish flag
75.	*Michelia champaca*L.	Magnoliaceae	Champa
76.	*Murraya koenigii* (L.) Spreng.	Rutaceae	Curry tree
77.	*Nerium oleander* L.	Apocynaceae	Oleander
78.	*Nyctanthus arbor-tristis* L.	Oleaceae	Coral Jasmine
79.	*Ocimum tenuiflorum*L.	Lamicaeae	Holy basil
80.	*Ricinus communis* L.	Euphorbiaceae	Castor oil plant
81.	*Rosa indica* L.	Rosaceae	Rose
82.	*Sauropus androgynus*(L.) Merr.	Phyllanthaceae	Star gooseberry

83.	*Tabernaemontana divaricata*(L.) R. Br. Ex Room & Schultz	Apocynaceae	Crape jasmine or Moonbeam

Table 4: List of Trees

Sl. No.	Scientific name of plants	Family	Common name
84.	*Albizia procera*(Roxb.) Benth.	Leguminosae	White siris
85.	*Alstonia scholaris*(L.) R. Br.	Apocynaceae	Devil's tree
86.	*Araucaria columnoris*(G.Forst) Hook	Araucariaceae	Christmas tree
87.	*Areca catechu* L.	Arecaceae	Betel nut
88.	*Artocarpus heterophyllus* Lam.	Moraceae	Jackfruit
89.	*Averrhoa carambola* L.	Averrhoaceae	Starfruit
90.	*Azadirachta indica* A. Juss.	Meliaceae	Indian lilac
91.	*Bambusa vulgaris* Schrad. Ex. J.C. Wendl.	Poaceae	Clumping bamboo
92.	*Bambusa wamin*E.G. Camus	Poaceae	Dwarf Buddha belly bamboo
93.	*Bauhinia purpurea* L.	Leguminosae	Orchid tree, butterfly tree
94.	*Butea monosperma*(Lam.) Taub.	Leguminosae	Flame-of-the-forest or Bastard teak
95.	*Cassia fistula* L.	Leguminosae	Indian laburnum
96.	*Ceasalpinia pulcherrima* (L.) Sw.	Leguminosae	Peacock flower
97.	*Cinnamomum verum* J.Presl	Lauraceae	Cinnamon
98.	*Cocos nucifera* L.	Arecaceae	Coconut palm
99.	*Combretum indicum* (L.) De Fillips	Combretaceae	Rangoon creeper
100.	*Ficus elastic* Roxb. Ex. Hornem	Moraceae	Rubber tree
101.	*Ficus hispida* L.	Moraceae	Hairy fig
102.	*Ficus racemosa* L.	Moraceae	Cluster fig or Red river fig
103.	*Mallotusphillipensis*(Lam.) Mull.	Euphorbiaceae	Kaamla tree or

	Arg.		Kumkum tree
104.	*Mangifera indica* L.	Anacardiaceae	Mango tree
105.	*Melia azedarach* L.	Meliaceae	Persian lilac
106.	*Mimusopselengi*L.	Sapotaceae	Spanish cherry
107.	*Moringa oleifera* Lam.	Moringaceae	Drumstick tree
108.	*Phyllanthus emblica*L.	Phyllanthaceae	Indian gooseberry
109.	*Plumeria obtusa*L.	Apocynaceae	White Fragipani
110.	*Polyalthia longifolia* (Sonn.) Thwaites	Annocaeae	False Asoka
111.	*Prunus dulchis*(Mill.) D.A. Webb	Rosaceae	Almond
112.	*Psidium guajava* L.	Myrtaceae	Guava tree
113.	*Roystonea regia* (Kunth) O.F. Cook	Arecaceae	Royal palm
114.	*Spondias pinnata* (L.f.) Kurz	Anacardiaceae	Wild mango
115.	*Syzyzium campanulatum*Korth	Myrtaceae	Christina tree
116.	*Tectona grandis* L.f.	Lamiaceae	Teak
117.	*Thuja occidentalis* L.	Cupressaceae	North White Cedar
118.	*Ziziphus jujuba* Mill.	Rhamnaceae	Red date or Chinese date
119.	*Dypsis decaryi*(Jum.) Beentje & J. Dransf.	Arecaceae	Triangle palm

Table 5: List of Climbers

Sl. No.	**Scientific name of plants**	**Family**	**Common name**
120.	*Asparagus racemosus*Willd.	Asparagaceae	Climbing Asparagus
121.	*Clitoriaternatea*L.	Leguminosae	Asian pigeonwings
121.	*Cuscutareflexa*Roxb.	Convolvulaceae	Dodder plant
123.	*Lagenaria siceraria* (Molina) Standl	Cucurbitaceae	Bottle gourd
124.	*Mikania micrantha* Kunth	Compositae	Bitter vine or climbing hemp vine
125.	*Momordica charantia* L.	Cucurbitaceae	Bitter gourd

126.	*Paederia foetida*L.	Rubiaceae	Skunk vine
127.	*Piper nigrum* L.	Piperaceae	Black pepper
128.	*Tinospora sinensis* Lour. (Merr)	Menispermaceae	Chinese tinospora

Table 6: List of Aquatic Plants

Sl. No.	Scientific name of plants	Family	Common name
129.	*Eichhornia crassipes* Mart.	Pontederiaceae	Common water hyacinth
130.	*Hydrilla verticillata*(L.f.) Royle	Hydrocharitaceae	Water thyme
131.	*Hymena chneamplexicaulis* (Rudge) Nees	Poaceae	Marsh grass
132.	*Ipomoea aquatica* Forssk.	Convolvulaceae	Water morning glory
133.	*Marsilea quadrifolia*L.	Marsileaceae	Water clover
134.	*Pericaria glabra* (Willd.) M.Gomez	Polygonaceae	Dense flower Knotweed
135.	*Pistia stratiotes* L.	Araceae	Water lettuce
136.	*Vallisneria gigantea* L.	Hydrocharitaceae	Eelgrass
137.	*Vallisneria spiralis* L.	Hydrocharitaceae	Tapegrass

Table 7: List of Epiphytes

Sl. No.	Scientific name of plants	Family	Common Names
138.	*Acampe rigida* (Buch.-Ham. Ex Sm.)	Orchidaceae	Stiff Acampe
139.	*Aerides rosea* Lodd. ex Lindl. & Paxton	Orchidaceae	Fox Brush Orchid
140.	*Coelogyneassamica*Linden &Rchb. F.	Orchidaceae	The Assam Coelogyne
141.	*Cymbidium aloifolium*(L.) Sw.	Orchidaceae	Aloe-leafed cymbidium
142.	*Dendrobium lituifloram*Lindl.	Orchidaceae	Bent-racemed dendrobium
143.	*Liparis viridiflora*(Blume) Lindle.	Orchidaceae	Green-Flowered

			Liparis
144.	*Rhynchostylis retusa* (L.) Blume	Orchidaceae	Foxtail orchid

Table 8: List of Seasonal Flowers and Ornamental Plants

Sl. No	Scientific name of plants	Family	Common Names
145.	*Anthurium andraeanum*Linden ex Andre	Araceae	Flamingo Flower
146.	*Araucaria heterophylla* (Salisb.) Franco	Araucariaceae	Christmas Tree
147.	*Bambusa multiplex* (Lour.) Raeusch. ex Schult. f.	Poaceae	Hedge Bamboo
148.	*Bougainvillea glabra* Choisy	Nyctaginaceae	Bougainvillea
149.	*Caesalpinia pulcherrima* (L.) Sw.	Fabaceae	Peacock Flower
150.	*Chrysanthemum grandiflorum* (Ramat.) Hemsl.	Asteraceae	Indian Crysanthemum
151.	*Clitoria ternatea*L.	Fabaceae	Butterfly Pea
152.	*Combretum indicum* (L.) DeFilipps	Cobretaceae	Rangoon Creeper
153.	*Cycas revoluta* Thunb.	Cyacadaceae	Sago Palm
154.	*Dahlia pinnata* Carv.	Asteraceae	Dahlia
155.	*Draceana trifasciata*(Prain) Mabb.	Asparagaceae	Snake plant
156.	*Dypsis lutescens*(H.Wendl.) Beentje & J.Dransf.	Arecaceae	Golden Cane Palm
157.	*Euphorbia milii* Des. Moul.	Euphorbiaceae	Giant Crown of Thorns
158.	*Ficus benjamina* L.	Moraceae	Weeping Fig
159.	*Gerbera jamesonii* Bolus ex Hooker.f.	Asteraceae	Gerbera Daisy
160.	*Helianthus annuus* L.	Asteraceae	Sunflower
161.	*Hibiscus rosa-sinensis* L.	Malvaceae	China Rose
162.	*Hydrangea macrophylla* (Thunb.)	Hydrangeaceae	Hydrangea

	Ser.		
163.	*Ixora coccinea* L.	Rubiaceae	Jungle Geranium
164.	*Petunia atkinsiana*(Sweet) D.Don ex W.H. Baxter	Solanaceae	Petunia
165.	*Pinus roxburghii*Sarg.	Pinaceae	Chir Pine
166.	*Portulaca oleraceae*L.	Portulaceae	Purslane
167.	*Pyrostegiavenusta*(Ker Gawl.) Miers	Bignoniaceae	Flame vine
168.	*Rosa indica* L.	Rosaceae	Rose
169.	*Salvia splendens* Sellow ex J.A. Schultes	Lamiaceae	Scarlet Sage
170.	*Tabernaemontanadivaricata*R.Br. ex Roem. & Schult.	Apocynaceae	Crepe jasmine
171.	*Tagetes erecta*L.	Asteraceae	Mexican marigold
172.	*Tradescantia pallida* (Rose) D.R. Hunt	Commelinaceae	Purple heart
173.	*Wodyetia bifurcate* A.K. Irvine	Areceae	Foxtail palm
174.	*Zamia furfuracea*L. f.	Zamiaceae	Jamaican sago

Table 9: List of Seasonal Vegetables Cultivated

Sl. No	**Scientific name of plants (Common name)**	**Family**	**Common Names**
175.	*Allium cepa* L.	Amaryllidaceae	Onion
176.	*Amaranthus caudatus*L.	Amaranthaceae	Foxtail Amaranth
177.	*Brassica oleracea var. botrytis* L.	Brassicaceae	Cauliflower
178.	*Brassica oleracea var. capitata* f. alba	Brassicaceae	Cabbage
179.	*Brassica oleraceae var gongylodes* L.	Solanaceae	Kohlrabi
180.	*Brassica oleraceae var. italica*L.	Solanaceae	Broccoli
181.	*Capsicum annum* L.	Solanaceae	Chilly
182.	*Capsicum chinense*Jacq.	Solanaceae	Habanero-type pepper

183.	*Carica papaya* L.	Caricaceae	Papaya
184.	*Colocasia esculenta* (L.) Schott.	Araceae	Taro
185.	*Cucumis sativus* L.	Cucurbitaceae	Cucumber
186.	*Frageriaananassa*Duchesne	Rosaceae	Strawberry
187.	*Lagenaria siceraria* (Molina) Standl.	Cucurbitaceae	Bottle Gourd
188.	*Momordica dioica* Roxb. Ex Willd.	Cucurbitaceae	Teasel Gourd
189.	*Murrayakoenigii*(L.) Spreng.	Rutaceae	Curry Leaves
190.	*Musa acuminata* Collasp.	Musaceae	Banana
191.	*Musa paradisiaca* L.	Musaceae	Plaintain
192.	*Polygonum microcephalum*D.Don	Polygonaceae	Tiny Head Knotweed
193.	*Solanum lycopersicum*L.	Solanaceae	Tomato
194.	*Solanum melongena* L.	Solanaceae	Brinjal
195.	*Solanum tuberosum* L.	Solanacaeae	Potato
196.	*Spinacia oleracea* L.	Amaranthaceae	Spinach

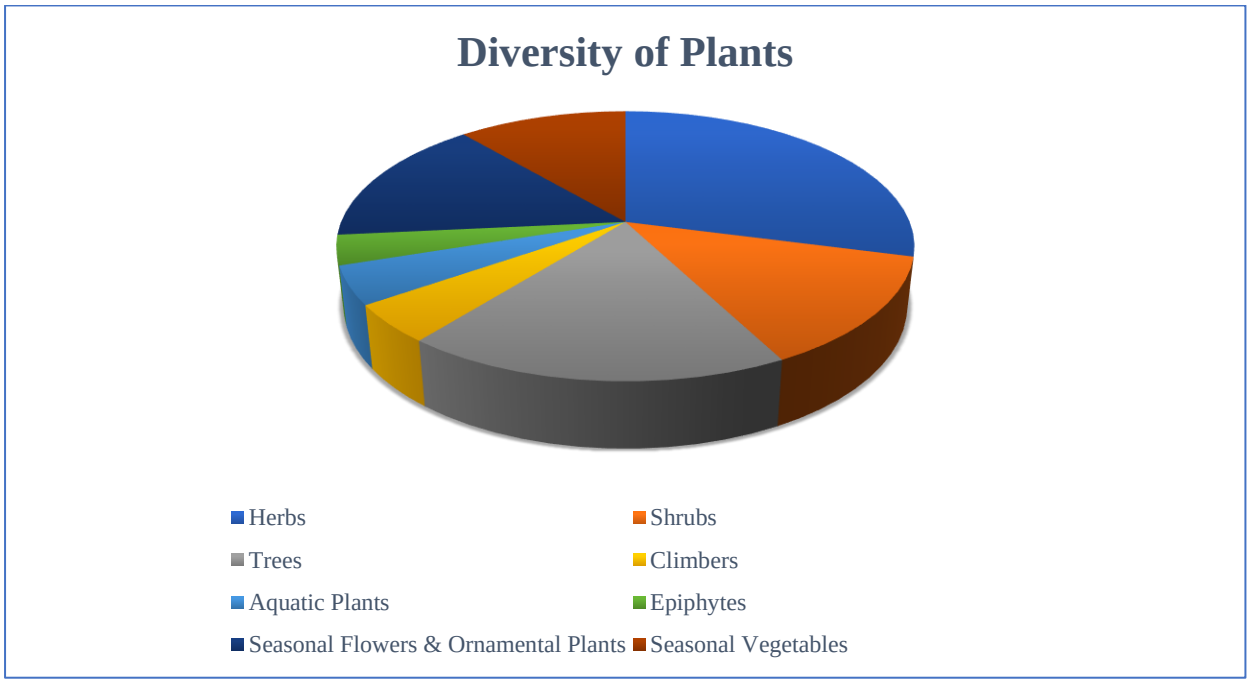


Figure 13: Graphical representation of plant species abundant within the college campus

4.2. Faunal Diversity

The college campus area supports varieties of faunal species of mammals, Aves, reptiles, amphibians, fishes and invertebrates. Mammalian species like Mongoose, house shrew, squirrel is found in the college area. A large variety of birds are found in the campus which includes Black Kite, Common Kingfisher, cattle Egret, Spotted Dove, Yellow footed green pigeon, Rose ringed parakeet, Spotted owlet, Asian Koel, large-billed crow, common myna and many others. Common Asian toad, common tree frog, Indian bull frog, Assam forest frog are among the amphibians in the campus. Snake like Red necked keelback, Copper-headed Trinket, Indian Rat snake, Monocled Cobra etc are common in the college campus. Tokay Gecko, Common house Gecko, Oriental garden lizard, Common garden skink are among the lizard species of the college campus. In the pond inside the college campus some fishes are found viz. Pool barb, swamp barb, spotted snakehead, walking catfish etc. Around 14 species of butterfly have been recorded in the college campus, some of which are Common Evening Brown, Dark Evening Brown, BluestripedPalmfly, Common Bushbrown, Common Nawab, Yellow Rajah, Common leopard, Common Tiger. A comprehensive list of faunal species has been prepared by the Dept. Of Zoology, Nowgong Girls' college to highlight the faunal diversity of the campus.

Bull Frog

House Sparrow

Cattle Egret

Garden Lizard

Common Leopard

Squirrel

Mice

Monocled Cobra

Figure 14: Faunal Diversity of Nowgong Girls' College

Table 10: Mammalian Diversity

Sl.No.	Family	Common Name	Scientific Name
1.	Herpestidae	Mongoose	*Herpestesedwardsi*
2.	Muridae	House Rat	*Rattus rattus*
3.		House Mouse	*Mus musculus*
4.	Soricidae	House shrew	*Suncus murinus*
5.	Sciuridae	Squirrel	*Callosciuruspygerithrus*

Table 11: Avian Diversity

Sl.No.	Family	Common Name	Scientific Name
1.	Accipitridae	Black Kite	*Milvus migrans*
2.	Alcedinidae	Common Kingfisher	*Alcedoatthis*
3.		White Throated Kingfisher	*Halcyon smyrnem*
4.	Ardeidae	Cattle Egret	*Bubulcus ibis*
5.		Indian Pond Heron	*Ardeolagrayii*
6.	Ciconidae	Greater Adjutant Stork	*Leptoptilosdubius*
7.	Columbidae	Spotted Dove	*Streptopelia chinensis*
8.		Yellow footed green Pigeon	*Treronphoenicoptera*
9.	Paridae	Cinereous tit	*Parus cinereus*
10.	Phalacrocoracidae	Little cormorant	*Phalacrocorax niger*
11.	Psittacidae	Rose-ringed Parakeet	*Psittaculakrameria*
12.	Picidae	Fulvous breasted wood pecker	*Dendrocoposmacei*
13.	Strigidae	Spotted Owlet	*Athene brama*
14.	Megalaimidae	Lineated Barbet	*Megalaimalineata*
15.		Blue-throated Barbet	*M. asiatica*
16.		Coppersmith Barbet	*M. haemacephala*
17.		Coppersmith Barbet	*M. haemacephala*
18.	Muscicapidae	Oriental Magpie-Robin	*Copsychussaularis*
19.	Cuculidae	Asian koel	*Eudynamusscolopacea*
20.	Corvidae	House Crow	*Corvus splendens*
21.		Large-billed Crow	*C. macrorhynchos*
22.	Rallidae	White Breasted Waterhen	*Amauroruisphoenicurus*
23.	Sturnidae	Asian Pied Starling	*Sturnus contra*
24.		Common Myna	*Acridotherestritis*
25.		Jungle Myna	*Acridotheresfuscus*
26.		Chestnut Tailed Starling	*Sturnus malabaricus*
27.	Passeridae	House Sparrow	*Passer domesticus*
28.		Tree Sparrow	*Passer montanus*
29.	Pycnonotidae	Red Vented Bulbul	*Pycnonotuscafer*

30.	Lanidae	Brown Shrike	*Lanius cristatus*
31.		Grey-Backed Shrike	*Lanius tephronotus*
32.	Oriolidae	Black-hooded Oriole	*Oriolusxanthornus*
33.	Dicruridae	Black Drongo	*Dicrurusmacrocercus*
34.	Motacillidae	White Wagtail	*Motacilla alba*
35.	Nectariniidae	Purple Sunbird	*Cinnyris asiaticus*
36.	Cisticolidae	Common Tailor Bird	*Orthotomussutorius*

Table 12: Amphibian Diversity

Sl.No.	**Family**	**Common Name**	**Scientific Name**
1.	Bufonidae	Common Asian Toad	*Duttaphrynusmelanostictus*
2.	Rhaphoridae	Common Tree Frog	*Polypedatesteraiensis*
3.	Ranidae	Indian Bull Frog	*Haplobatrachustigerina*
4.		Assam Forest Frog	*Sylviranaleptoglosa*

Table 13: Snake Diversity

Sl.No.	**Family**	**Common Name**	**Scientific Name**
1.	Colubridae	Red necked keelback	*Rhabophissubminiatus*
2.		Copper-headed Trinket	*Coelognathus radiates*
3.		Indian Rat snake	*Ptyas mucosa*
4.		Chekered keelback	*Xenochrophis piscator*
5.		Painted bronzeback	*Dendrelaphis pictus*
6.		Common wolf snake	*Lycodonaulicus*
7.	Elapidae	Monocled Cobra	*Najakaouthia*
8.		Banded krait	*Bungarusfasciatus*
9.	Homalopsidae	Common water snake	*Enhydrisenhydris*

Table 14: Lizard Diversity

Sl.No.	Family	Common Name	Scientific Name
1.	Gekkonidae	Tokay Gecko	*Gecko gecko*
2.		Common house Gecko	*Hemidactylus frenatus*
3.	Agamidae	Oriental garden lizard	*Calotes versicolor*
4.	Scincidae	Common garden skink	*Lampropholisguichenoti*

Table 15: Fish Diversity

Sl. No.	Family	Common Name	Scientific Name
1.	Cyprinidae	Pool barb	*Puntius sophore*
2.		Swamp barb	*Puntius chola*
3.	Anabantidae	Climbing perch	*Anabustestudineus*
4.	Channidae	Spotted snakehead	*Channa punctata*
5.	Clariidae	Walking catfish	*Clariusmagur*
6.	Heteropneustidae	Stinging catfish	*Heteropneustesfossilis*

Table 16: Butterfly Diversity

Sl. No.	Family	Common Name	Scientific Name
1.	Satyrinae	Common Evening Brown	*Melanitisleda ismene*
2.		Dark Evening Brown	*Melanitisphedimabela*
3.		BluestripedPalmfly	*Elymniaspatnapatna*
4.		Common Bushbrown	*MycalesisperseusBlasius*
5.	Charaxinae	Yellow Rajah	*Charaxesmarmax*
6.		Tawny Rajah	*Charaxespolyxenahierax*
7.	Nymphalinae	Common Castor	*Ariodnemerioneassama*
8.		Common leopard	*Phalantaphalantha*
9.		Common Yeoman	*CirrochroatycheMithila*
10.		Grey Pansy	*Precis atlitesatlites*
11.	Danainae	Glassy Tiger	*Paranticaagleamelonoides*

12.		Common Tiger	*Danaus genutia*
13.		Plain Tiger	*Danaus chrysippus*

Table 17: Dragonfly Diversity

Sl.No.	Family	Common Name	Scientific Name
1.	Gomphidae	Common Clubtail	*Ictinogomphusrapax*
2.	Libellulidae	Trumpet tail	*Acisomapanorpoides*
3.		Common picture wing	*Rhyothemisvariegate*
4.		Ground skimmer	*Diplacodestrivialis*
5.		Wandering glider	*Pantalaflavescens*

Table 18: Spider Diversity

Sl.No.	Family	Common Name	Scientific Name
1.	Araneidae	Common Garden Spider	*Neoscona mukerjei*
2.		Tropical Tent Web Spider	*Cytrophoracitricola*
3.		Garden Cross Spider	*Argiope pulchella*
4.	Salticidae	Common Wall Jumper	*Menemerusbirittatus*
5.		Adonson's Wall Jumper	*Hasariusadansoni*
6.	Theridiidae	Silver Comb Footed Spider	*Argyrodesargentatus*
7.	Sparassidae	Huntsman Spider	*Heteropodavenatoria*

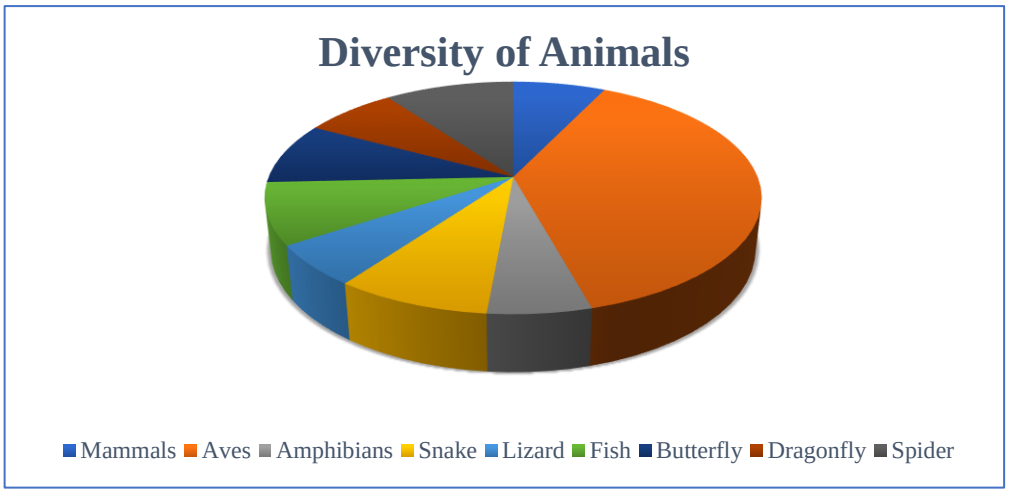


Figure 15: Graphical representation of animal species abundant within the college campus

5. Waste Management

Waste management is one of the most crucial steps in maintaining a sustainable environment. Solid waste, liquid waste containing toxic metals, organic solvents and e-wastes are generated in the college from different sources and proper management is necessary for their disposal to maintain the college campus pollution free from these. Waste bins labelled with types of waste are placed in appropriate places and all laboratories. In order to manage these perilous wastes efficiently, their proper identification, regular segregation and final treatment after disposal are some of the necessary steps taken to keep the campus clean, sustainable and safe. In this regard, the college has adopted adequate measures for minimizing the generation of waste, waste recycling and safe disposals of waste without causing harm to the environment.

5.1. Solid Waste Management

The solid wastes generated from various sources in the college are segregated regularly in separate blue, green and red bins, recycled and burnt in the college incinerator. Food wastes, vegetable peels and other biodegradable wastes are used in the vermicompost and waste assimilation unit in the college. The manure produced in the vermicompost and waste assimilator units is utilized for manuring the medicinal and flower garden of the college campus. Other solid wastes are also produced in the Nowgong Girls' College campus like plastic waste, construction waste and glass waste etc. The solid wastes generated per year at Nowgong Girls' College was 1098.40 Kg/ year. The highest of solid waste generated is the

construction waste of 503 kg/ year and Biodegradable waste of 319.40 kg/ year respectively. The Plastic waste of 53.20 kg/ year is the minimum.

Figure 16. (left) Vermicompost Unit; (right) Incinerator.

Table 19: Solid Waste Generation at Nowgong Girls' College

Category of Waste	Biodegradable waste	Plastic waste	Construction waste	Glass waste	Others	Total
Quantity Kg/ Year	319.40	53.20	703.10	121.30	101.40	1298.40
Percentage	24.60	04.09	54.15	11.04	09.34	100

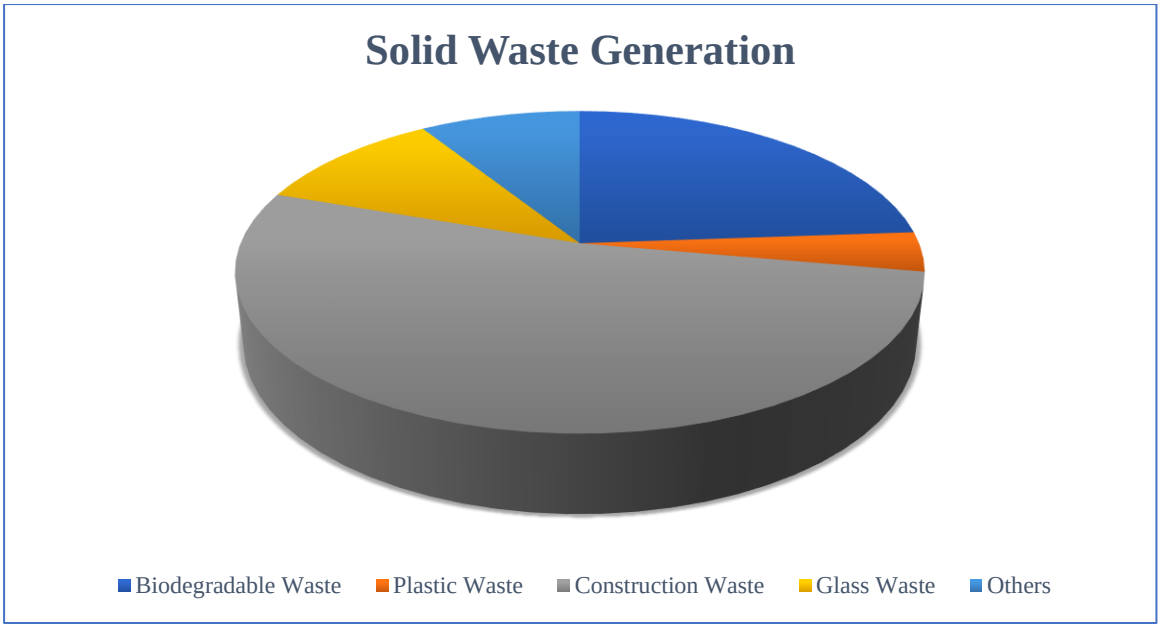


Figure 17: Pie diagram showing the percentage of solid waste generated at Nowgong Girls' College per year

5.2. Liquid Waste Management

Liquid waste from runouts, bathrooms is properly connected to drainage system and finally the drainage system is connected to the water bodies in the college campus.

A wide range of hazardous chemicals including liquid wastes containing toxic metals, reagents and organic solvents are produced in the used in the laboratories of Nowgong Girls' College. In order to manage these perilous objects efficiently, their proper identification, separate storage and final treatment of these disposals are some of the necessary steps. In this respect, the departments have adopted adequate measures for the safe disposals of noxious wastes without causing harm to the environment. To effectively implement these measures, the faculties make the students aware of such rules through orientation programmes. Here we have mentioned some of the procedures that are followed for minimising the generation of toxic hazards and their proper treatment.

The use of chlorinated or any other hazardous solvents and reagents are completed avoided in the college. The used chemical solvents are stored separately in respective containers. The used organic solvents are distilled to pure form so that it can be reused as far as possible. Before disposing the used chemicals, it is ensured that they are properly treated to make them harmless. For example, acids and bases are neutralized prior to discharge in drainage system. For most of the organic synthesis, organic solvents are used. However, alternative green chemistry approach is adopted wherever possible to minimize the use of harmful organic solvents. The used and expired solid organic and

inorganic chemicals are disposed by land filling in case of harmful chemicals and by drainage disposal for harmless chemicals. On an average, the laboratories generate various types of chemical wastes as given in Table 20.

Table 20: List of chemical wastes from laboratories

Sl. No.	Types of wastes	Amount generated (kg/year)	Percentage share	Disposal Procedure
1.	Acids	15	28.57	Neutralization and Drain
2.	Base	15	28.57	Neutralization and Drain
3.	Organic Solvents	5	9.52	Recycle
4.	Inorganic Chemicals	1	1.90	Land filling or Drain
5.	Organic Chemicals	0.5	0.95	Land filling or Drain
6.	Toxic metals	0.01	0.02	Phytoremediation
7.	Glass & Sharps	6	11.43	Recycle
8.	Solid	10	19.04	Burnt in Incineration
Total chemical waste		52.51	100	

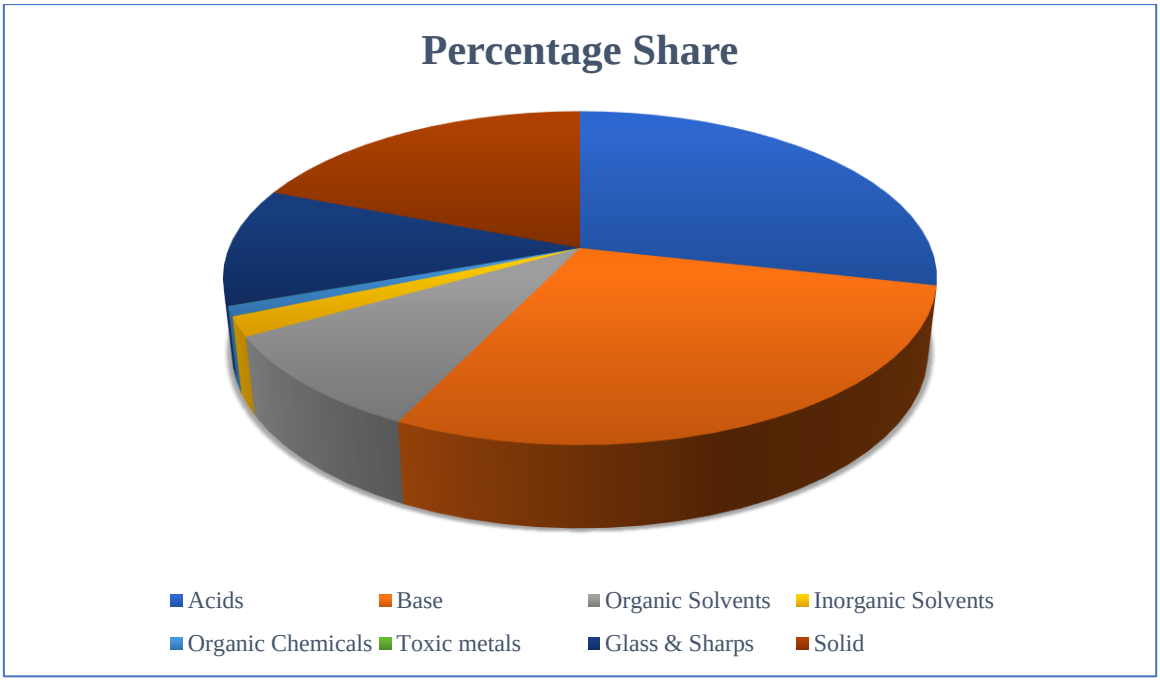


Figure 18: Pie diagram showing the percentage of various chemical wastes generated in the laboratories. The wastes generated are accounted for Chemistry, Zoology and Botany department's laboratories

5.2.1. Phytoremediation

The chemical laden liquid waste generated in the college from laboratories and other sources are treated in the phytoremediation unit in the college campus where hydrophytes are grown which absorbs many toxic materials from water. Plants like *Eichhornia* species and *Vallisneria* species are grown therein for this purpose. *Eichhornia* species is a hyper accumulator of toxic metals and can also tolerate the toxicity of phenol, formaldehyde, acetic acid and oxalic acid etc. Prior to pouring the liquid waste into the unit, the metal contents in it are determined. After the level of metal content gets reduced, the water is periodically discharged.

Figure 19: Phytoremediation unit

5.3. Electronic Waste management

Every educational institute is found to generate e-waste. Nowgong Girls' College is also observed to generate e-waste as computers, printers, scanners, xerox machines, internet routers, laptops and others are used for administrative, departmental, library and computer laboratory works. Presently, the college is dispatching the e-waste to Andhra Pradesh Pollution Control Board, Kurnool and it is given to authorised e-waste collector for recycling. The average e-waste generated in the college is nearly 43.4 kg/month.

6. Energy Audit at Nowgong Girls' College

6.1. Electrical Power Consumption

Energy conservation is essential for the globe and the same has been practiced in Nowgong Girls' College attempting to reduce the use of electricity. To fulfill that, the college has installed solar plants and low power consuming LED bulbs within the campus as well as within the hostels.

Table 21: List of electrical equipment in college

Sl. No.	Devices	No. of appliances	Power (W)
1.	Number of CFL bulbs	52	18
2.	Number of Incandescent bulbs	3	60
3.	LED Tube lights	10	18

4.	LED bulbs	60	10
5.	Tube lights	149	36
6.	Fans	222	60
7.	ACs (7.5 Ton)	7	7500
8.	ACs (1 Ton)	8	1000
9.	Computers	96	186
10.	Refrigerators	2	150
11.	Water pump	2	735
12.	Water Filter	15	100
13.	Photocopier	4	1000
14.	Printers	28	120
15.	LCD projector	10	350
16.	Television	10	100
17.	Online UPS	3	557
18.	Water heaters	2	1500
19.	Scanner	6	45

Table 22: Equipment using electrical power in different Laboratories in the college

Sl. No.	Devices	No. of appliances	Power (W)
1.	Digital Balance	4	50
2.	Magnetic Stirrer	3	500
3.	Melting point apparatus	1	100
4.	Conductivity meter	1	904
5.	Calorimeter	1	--
6.	Oven-1	1	350
7.	Distillation Plant	1	3.5
8.	PH Meter	1	100
9.	Optical Microscope	11	23
10.	Water bath	1	--
11.	Paraffin wax bath	1	--
12.	Centrifuge	2	1050

13.	Incubator	1	--
14.	Hot Air Oven	1	1000
15.	Autoclave	1	1500
16.	Haemocytometer	2	--
17.	Spectrophotometer	1	--
18.	Digital Automatic Colorimeter	2	100
19.	Boiler	2	1000
20.	Galvanometer to Voltmeter/Ammeter	3	—
21.	Logic Gates	3	—
22.	Sodium Lamp	4	150

Table 23: Electric Appliance Audit Sheet

Sl. No.	Devices	No of appliances	Power (W)	Usage per day (Hours)	Average energy consumed (kWh) per day	Average energy consumed (kWh) per Month
1.	CFL bulbs	52	18	6	5.61	134.78
2.	Incandescent bulbs	3	60	2	0.36	8.64
3.	LED Tube lights	10	18	6	1.08	25.92
4.	LED bulbs	60	10	6	3.6	86.40
5.	Tube lights	149	55	6	49.17	1180.08
6.	Fans	222	60	6	79.92	1918.08
7.	ACs (1 Ton)	8	1000	2	16	384.00
8.	Computers	96	186	6	107.13	2571.26
9.	Refrigerators	2	150	10	3	72
10.	Water pump	2	735	2	2.94	70.56
11.	Water Filter	15	100	3	4.5	108
12.	Photocopier	4	1000	0.5	2	48
13.	Printers	28	120	0.2	0.67	16.12

14.	LCD projector	10	350	2	7	168
15.	Television	10	100	2	2	48
16.	Online UPS	3	557	2	3.34	80.20
17.	Water heaters	2	1500	0.3	0.9	21.6
18.	Scanner	6	45	0.3	0.08	1.94
19.	Laboratory Equipment	Inclusive of all laboratories	10810.5 (Approx)	1	10.81	259.45
					Total:	7203.03

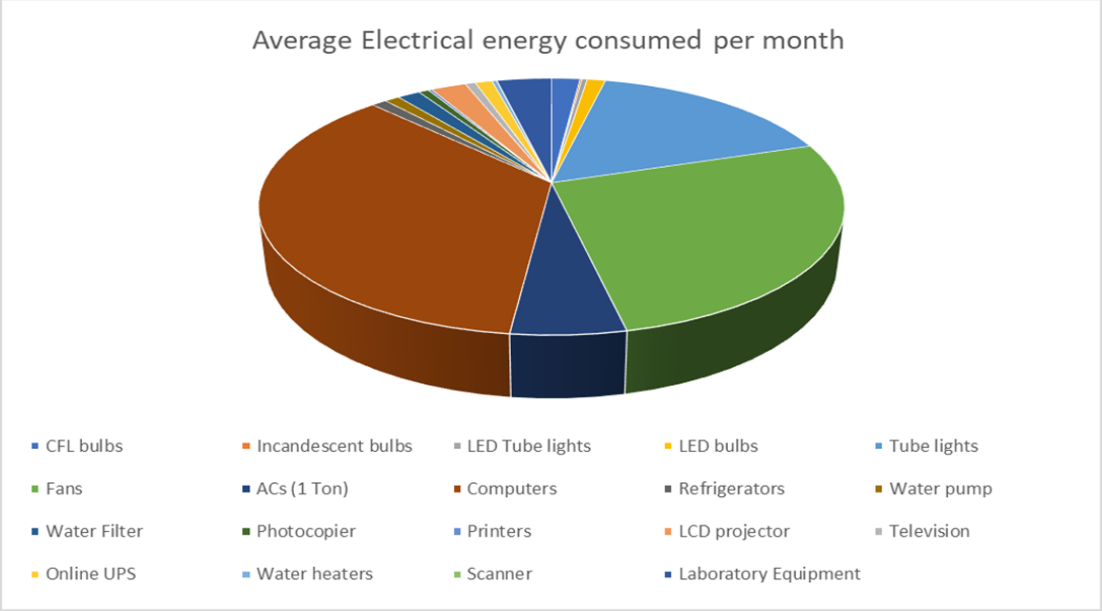


Figure 20: Diagrammatic representation of the Average Electrical energy consumed per month

Nowgong Girls' College have been using 7312.13 kWh unit of Electricity (According to the APDCL electricity Bill) on an average per month. This power includes all the electrical devices present in the college premises and the two hostels. The approximate power consumption of all the electrical devices is tabulated in Table 21 and Table 22. In Table 23, total power consumption per month is calculated on the basis of existing electrical equipment.

The LED bulbs present in the campus contributes to 1.55 % of the total power. Similarly, the Solar plants placed at the rooftop of the hostels and other places within the campus contributes 0.63 % of the total power requirements.

Figure: **LED bulbs in classrooms**

Figure:Rooftop Solar Plants

Figure 21: Energy conservation and alternate sources of energy

6.2.LPG Consumption

In addition to electricity, the fuel used in the canteen, laboratories, hostel and others (like Home Science department and administrative building) is LPG. The fuel consumption has been tabulated below:

Table 24: LPG consumption at Nowgong Girls' College

Sl. No.	Place	Quantity used (kg/ year)
1.	Canteen	468.6
2.	Laboratories	28.4
3.	Hostel	1, 562
4.	Others	14.2
	Total LPG consumed	2, 059

7. Environmental Quality Audit of Nowgong Girls' College

7.1. Air Pollution Audit

Air pollution in the college campus is mainly caused by vehicles, electricity generator, air conditioners, cooking equipments in the college canteen, various equipments and some volatile compounds used in the laboratories, dust etc. Some common methods adopted by the college to reduce air pollution is cultivation of more plants in the college campus, minimum utilisation of machineries that emits harmful gases, use of bicycle in the college campus.

The institute do not have in-house facility to monitor the monthly air quality data. In view of this, the data tabulated below (Table 25) was reproduced from the website of Central Pollution Control Board (CPCB), Ministry of Environment, Forest, and Climate Change, India. A continuous evolution and monitoring of such datasets are therefore necessary to comment on the quality of air in this region. We are currently working in this aspect.

Table 25: Monthly averaged air quality data

Parameters (Units)	**December 2020**	**January 2021**
Pollutants		
CO (ppm)	1.62	1.85
O_3 (ppb)	19.12	19.43
NO	49.25	33.50
NO_2 (ppb)	16.68	13.06
NOx (ppb)	45	43
NH_3 (ppb)	3.68	4.06
PM2.5 (ppb)	128	146
PM10 (ppb)	250	237
SO_2 (ppb)	22	27
Benzene (ppb)	0	0
Meteorological Parameter		
AT (°C)	18	18

BP (mmHg)	883	891
RH (%)	75	79
Solar Radiation (W/m^2)	246	219
Wind Speed (m/s)	1	1
Wind Direction (degree)	134	143

Source: Pollution Control Board Assam, Bamunimaidam, Guwahati – 21

7.2. Noise Level Audit in the Surrounding

Noise measuring meter or app, Sound Meter was used to measure the wise level. Sound meter app can detect any sounds, noise and music in the surrounding area. It provides maximum, minimum and average decibels of was recorded at the different important locations of Nowgong Girls' College, Nagaon. At each spot, the measurements were taken for 60 seconds during day time (6am-6pm) documented the noise level measurements. The data were collected by 5th Semester Students of Chemistry and Physics Departments of Nowgong Girls' College. The average highestsound measured was 75 dBA in the College Main Gate and the average lowest sound recorded was 42 dBA from the College Library.

Table 26: Measurement of Noise in different locations of Nowgong Girls' College

Locations	Measurements (Duration in Seconds)	Maximum (dBA)	Minimum (dBA)	Average (dBA)
Administrative Building and Science Block- B	60	72	34	58
Arts Block	60	71	37	56
Auditorium	60	68	38	52
Botany Department	60	72	32	51
Canteen	60	81	52	66
College Main Gate	60	89	54	75
Digital Seminar Hall	60	75	53	64
Girls' Hostel (PDP)	60	85	56	71

Girls' Hostel(SBP)	60	81	50	67
Indoor Stadium	60	82	70	73
KKHSOU Study Centre and Post Office	60	72	40	68
Library	60	67	32	42
Open Stage	60	75	56	71
Physics Department	60	69	33	47
Play Ground	60	86	56	69
Science Block-A	60	86	53	67

7.3.Water Pollution Audit

We assessed the quality of water in collaboration with P.H.E. Department, Mohkhuli, Nagaon, Assam and Regional Agricultural Research Station (AAU), Shillongani, Nagaon, Assam. We collected three samples primarily from the administrative block of the institute, NowgongGirls' College hostel and a nearby town and analysed the various parameters as tabulated in Table 27. From the analysis it can be concluded that the quality of unfiltered water in all the three samples are below the BIS permissible limit, however some parameters are above the BIS limit. So, it can be inferred that the water samples are safe for drinking after filtration.

Table 27: Water analysis report

Parameters	**BIS Limit**	**BIS Permissible Limit**	**Observed Value**			**Methodology**
			Sample 1	**Sample 2**	**Sample 3**	
Colour			Colourless	Colourless	Colourless	Visual
Ph	6.5-8.5	6.5-8.5	7	7.5	8	IS 3025 [p11]
Turbidity	1 NTU	5 NTU	0	0	0	IS 3025 [p10]
Hardness	200 ppm	600 ppm	150 ppm	150 ppm	300 ppm	IS 3025 [p21]
TDS	500 ppm	2000 ppm	400 ppm	300 ppm	700 ppm	IS 3025 [p16]
Fe	0.30 ppm	1 ppm	0.2 ppm	0.3 ppm	0 ppm	IS 3025 [p53]

Cu	0.05 ppm	1.5 ppm	0	0	0	IS 3025 [p65]
Mn	0.1 ppm	0.3 ppm	0	0	0	IS 3025 [p65]
Mg	30 ppm	100 ppm	50 ppm	70 ppm	40 ppm	IS 3025 [p65]
Ca	75 ppm	200 ppm	100 ppm	80 ppm	110 ppm	IS 3025 [p65]
F^-	1 ppm	1.5 ppm	0	0	0	ASTM D4646
Cl^-	250 ppm	1000 ppm	120 ppm	80 ppm	100 ppm	IS 3025 [p32]
Residual Cl	0.2 ppm	1 ppm	0	0	0	IS 3025 [p26]
NO_3^-	45 ppm	45 ppm	4 ppm	7 ppm	8 ppm	IS 3025 [p34]
SO_4^{2-}	200 ppm	400 ppm	100 ppm	90 ppm	150 ppm	IS 3025 [p24]

Sample 1: Collected from Amollapatty, Nagaon, Assam

Sample 2: Collected from Administrative Block, Nowgong Girls' College, Assam

Sample 3: Collected from Nowgong Girls' College Hostel, Nagaon, Assam

A.

Figure 22A, 22B: Water Quality Testing

A. P.H.E. Department, Mohkhuli, Nagaon

B. Regional Agricultural Research Station, Shillongoni, Nagaon

7.3.1. Water Management in the College

- Rain water harvesting system.
- Bore wells to recharge ground water.
- Small ponds for collection of runaway water.
- Conduction of water conservation awareness programmes.

7.4. Soil Pollution Audit

Soil pollution in the college campus is mainly due to plastic wastes such as packets of various chips and other eatables and polythene carrybags though the plastics bags are ban inside the college. To reduce soil pollution the college has initiated plastic free campus. Properly labelled dust bins are placed at specific sites for disposal of any kind of plastics after use.

Figure 23: Dustbins

8. Health Audit

Proper health of all the students, faculties, staff and other members of the college is given utmost importance. Various health awareness programmes on health and hygiene, diet, certain diseases and camps like haemoglobin estimation, blood group testing, blood sugar estimation, blood donation, blood pressure checking etc are regularly conducted in the college. Proper health care of the students is taken in the college hostels and practices like yoga is encouraged.

Figure 24 A. Blood Donation Camp at Nowgong Girls' College

Figure 24 B. Haemoglobin estimation, Blood group testing, Blood sugar estimation and Blood Pressure checking at Nowgong Girls' College

9. Management Strategy

We have prepared a Management Strategy for Nowgong Girls' College which will give priority in the improvement of the environment for a green and clean campus.

- **Floral and Faunal Diversity and Management:** Proper naming of the Epiphytes, shrubs and trees. The campus is rich in flora and plantation of some indigenous plants

like *Barringtonia acutangula* (L.) Gaertn. (Mango Pine tree) is required for better result of faunal diversity.

- **Solid Waste Management**

  i. **Paper / Biodegradable Waste:** Lesser use of paper and use of IT Technology for communication.

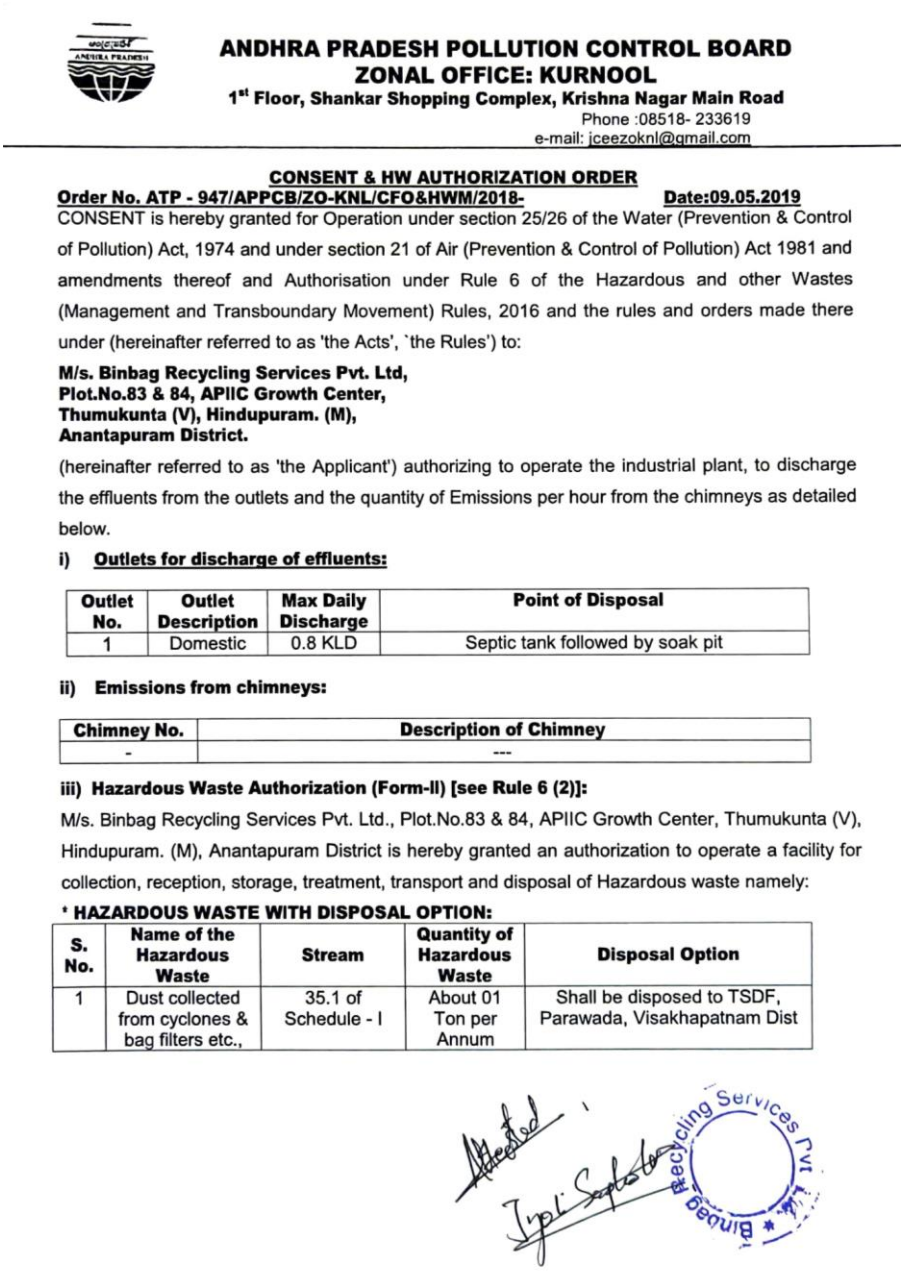
  ii. **Plastic Waste:** Ban on single use plastic and sending plastics for recycling.

Figure 25: Signboard displaying ban on single use plastic

- **Water Management:** Rainwater harvesting already installed in the college. Proper maintenance of plumbing facilities in the college.

Figure 26: Rainwater harvesting

- **Energy Management:** Installation of more solar panels and replacement of old lights and Fans with more energy efficient appliances. Use of solar pumps for water tanks. Street light electrification by solar energy.
- **E-Waste Management:** Collection of e-waste by some concerned departments for recycling processes.



ANDHRA PRADESH POLLUTION CONTROL BOARD
ZONAL OFFICE: KURNOOL
1st Floor, Shankar Shopping Complex, Krishna Nagar Main Road
Phone :08518- 233619
e-mail: jceezoknl@gmail.com

CONSENT & HW AUTHORIZATION ORDER

Order No. ATP - 947/APPCB/ZO-KNL/CFO&HWM/2018- **Date:09.05.2019**

CONSENT is hereby granted for Operation under section 25/26 of the Water (Prevention & Control of Pollution) Act, 1974 and under section 21 of Air (Prevention & Control of Pollution) Act 1981 and amendments thereof and Authorisation under Rule 6 of the Hazardous and other Wastes (Management and Transboundary Movement) Rules, 2016 and the rules and orders made there under (hereinafter referred to as 'the Acts', `the Rules') to:

M/s. Binbag Recycling Services Pvt. Ltd,
Plot.No.83 & 84, APIIC Growth Center,
Thumukunta (V), Hindupuram. (M),
Anantapuram District.

(hereinafter referred to as 'the Applicant') authorizing to operate the industrial plant, to discharge the effluents from the outlets and the quantity of Emissions per hour from the chimneys as detailed below.

i) Outlets for discharge of effluents:

Outlet No.	Outlet Description	Max Daily Discharge	Point of Disposal
1	Domestic	0.8 KLD	Septic tank followed by soak pit

ii) Emissions from chimneys:

Chimney No.	Description of Chimney
-	---

iii) Hazardous Waste Authorization (Form-II) [see Rule 6 (2)]:

M/s. Binbag Recycling Services Pvt. Ltd., Plot.No.83 & 84, APIIC Growth Center, Thumukunta (V), Hindupuram. (M), Anantapuram District is hereby granted an authorization to operate a facility for collection, reception, storage, treatment, transport and disposal of Hazardous waste namely:

*** HAZARDOUS WASTE WITH DISPOSAL OPTION:**

S. No.	Name of the Hazardous Waste	Stream	Quantity of Hazardous Waste	Disposal Option
1	Dust collected from cyclones & bag filters etc.,	35.1 of Schedule - I	About 01 Ton per Annum	Shall be disposed to TSDF, Parawada, Visakhapatnam Dist

Attested
Binbag Recycling Services Pvt. Ltd.

Figure 27: Agency/Department collecting e-wastes and hazardous waste from Nowgong Girls' college.

- **Fuel Management:** Students are encouraged to travel by cycles and battery rikshaws (available in the town area), two wheelers rather than four wheelers which will lead to fuel saving and also the contribution of pollutants to the atmosphere will be less.
- **Air and Noise pollution Management:**Though the air quality is in good condition still plantation of some trees like *Polyalthia longifolia* (Sonn.) Thwaites (False Asoka) is required for better results.

10. Recommendations

- Installation of more solar panels.
- Replacement of old bulbs with low power consuming LED bulbs.
- Water recycling units to be installed.
- Develop a biodiversity park.
- Planting of more indigenous trees particularly *Barringtonia acutangula* (L.) Gaertn. (Mango Pine) because of suitable climatic conditions.
- Enhancement of medicinal plant garden.
- Conduction of seminars, workshops and extension activities related to environment awareness.
- Participation of all teachers, staff, students and other members of the college in local environmental issues.
- Minimise use of electricity as much as possible and use of more solar energy.
- Use of 3R's (Reduce, Reuse, Recycle) wherever possible.

11. Conclusion

Green, energy and environment audit helps to identify the strength and weakness related to sustainable management of environment. It helps us to find ways to solve environmental problems. Through green audit proper utilisation of natural, economic and social resources can be done. The college gives utmost importance to green audit as through this the environment of the campus can be assessed and necessary actions can be taken to make the college campus environment friendly and progress for sustainable development.