

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

POLICY ON CONSERVATION, RESTORATION AND SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEM



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SATHYABAMA
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CONSERVATION, RESTORATION AND SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEM

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1. INTRODUCTION

Sathyabama Institute of Science and Technology, Chennai is located within the Chennai city premises and identified as a marshy land ecosystem. The campus covers ~200 acres with a significant portion as a green cover providing a balance between buildup environment and green space. The campus has widespread rainwater harvesting bodies on both sides of the main building providing habitat for numerous above and below ground aquatic animals and plant species. Sathyabama focuses on developing a sustainable environment with a greener and cleaner campus for students and faculty. The institute thrives to be self-sustainable in the areas of energy, water, and cleanliness and promotes research and technologies related to renewable energy, green fuel, rainwater harvesting, recycling wastewater through a sewage treatment plant (STP), plastic-free zone, community garden, extension services, conservation, and monitoring programs.

At Sathyabama, **biodiversity and conservation** focus on promoting and educating students, researchers, technicians, care-takers, faculties, and local people in conserving local biodiversity for a sustainable livelihood. The main objective is to create awareness, educate, and develop knowledge and skills to tackle biodiversity-related issues concerning the local context. At Sathyabama, biodiversity conservation has been consciously incorporated in the student curriculum as environment and disaster management studies and environmental science and engineering. The student volunteers have actively participated in monitoring, sampling, and restoration programs. Apart from biodiversity conservation, the research team of the institute has initiated studies on precision agriculture focusing on technologies to adapt and mitigate climate change and thereby increase farm production and productivity. The research focus includes the application of robotics in farm mechanization, integrated landscape management, use of sensors in plant

health, geoinformatics and crop modeling in the farming sector, nano-based delivery of nutrients and pesticides, crop surveillance, and urban agriculture.

2. MEASURING AND MONITORING PROGRESS

2.1 Step 1: Biodiversity monitoring and maintenance

Sathyabama institute has been instrumental in documenting the flora and fauna on campus. The basic knowledge about the biodiversity on the Sathyabama campus was explored by a team of student volunteers and faculty time to time. Initially, the team has documented twenty different tree species on campus belonging to 13 families with two cultivated invasive tree species, one ornamental invasive tree species, and two wild invasive tree species. The two invasive wild tree species were removed from campus to promote the indigenous ecosystem providing habitat for native birds, insects, and microbial community. The tree species available on campus are listed in Table 1.

Student volunteers were involved in a visual survey of native and indigenous plant and weed species, identifying invasive weed species, and documenting them under the guidance of scientists and faculties of the institute (Table 1 and 2). 276 invasive plant species have been reported from Tamil Nadu (Envis 2020), of which 13 species have been observed on campus (Table 2). Invasive weed species were hard to completely eradicate because of their reproductive biology but were monitored periodically and eradicated along with restoration of the ecosystem with native indigenous tree species like *Thespesia* spp., *Millettia pinnata*, and *Azadirachta indica* (Figure 1). Indigenous plant species encourage a healthy ecosystem supporting the lives of numerous birds, insects, and other microbial communities.

Table 1: List of flora on campus

S.No	Common anme	Scientific name	Family	Native or invasive

1.	Pongai	<i>Millettia pinnata</i>	Fabaceae	Native
2.	Neem	<i>Azadirachta indica</i>	<u>Meliaceae</u>	Native
3.	Jasmine	<i>Jasminum sambac</i>	Oleaceae	Native
4.	Indian almond	<i>Terminalia catappa</i>	<u>Combretaceae</u>	Native
5.	Monkey pod tree	<i>Samanea saman</i>	Mimosaceae	Native
6.	Ixora	<i>Ixora coccinea</i>	Rubiaceae	Native
7.	Indian laurel	<i>Calophyllum inophyllum</i>	Guttiferae	Native
8.	Earpod wattle	<i>Acacia auriculiformis</i>	<u>Fabaceae</u>	Native
9.	Hibiscus	<i>Hibiscus rosasincensis</i>	Malvaceae	Native
10.	Jasmine	<i>Jasminum grandiflorum</i>	Oleaceae	Native
11.	Ashoka tree	<i>Saraca asoca</i>	Fabaceae	Native
12.	Fire tree	<i>Delonix regia</i>	Fabaceae	Native
13.	Golden shower	<i>Cassia fistula</i>	Fabaceae	Native
14.	Bamboo	<i>Bambusa vulgaris</i>	Poaceae	Native
15.	Spanish cherry	<i>Mimusops elengi</i>	<u>Sapotaceae</u>	Native
16.	Guava	<i>Psidium guajava</i>	<u>Myrtaceae</u>	Invasive
17.	Paper flower	<i>Bougainvillea</i>	<u>Nyctaginaceae</u>	Invasive
18.	Coconut	<i>Cocos nucifera</i>	Arecacea	Invasive
19.	Copper pod	<i>Peltophorum pterocarpum</i>	Fabaceae	Invasive
20.	River tamarind	<i>Leucaena leucocephala</i>	Fabaceae	Invasive

Table 2: List of predominant invasive weed species observed on campus

S.No	Common name	Scientific name	Family
1.	Spiny pigweed	<i>Amaranthus spinosus</i>	Amaranthaceae
2.	Pepper leaved senna	<i>Senna sophora</i>	Fabaceae
3.	Prosopis	<i>Prosopis juliflora</i>	Fabaceae
4.	Lantana	<i>Lantana camara</i>	<u>Verbenaceae</u>
5.	Carrot grass	<i>Parthenium hysterophorus</i>	Asteraceae
6.	Smooth joyweed	<i>Alternanthera paronychioides</i>	Amaranthaceae
7.	Coffee senna	<i>Cassia occidentalis</i>	Fabaceae
8.	Phasey bean	<i>Macroptilium lathyroides</i>	Fabaceae
9.	White wort	<i>Leucas martinicensis</i>	Lamiaceae
10.	Milkweed	<i>Calotropis gigantean</i>	Apocynaceae
11.	Castor	<i>Ricinus communis</i>	Euphorbiaceae
12.	Pink morning glory	<i>Ipomoea carnea</i>	<u>Convolvulaceae</u>
13.	Australian pine tree	<i>Cassurina equisetifolia</i>	Casurinaceae



A. Millettia pinnata



B. Thespesia sps

Fig. 1: Restoration of the ecosystem with native indigenous tree species



Fig. 2: Lepidopteran order insect spp. on campus

Along with the plant species, the above-ground insect ecosystem was also monitored at periodic intervals (Table 3). Pre-monsoon and post-monsoon surveys for insect diversity showed a decline in the order Lepidoptera in the post-monsoon season. The factors behind the decline have to be evaluated in the upcoming years.

Table 3: List of insect orders observed on campus

S.No	Order	No. of genus observed under the specific insect order	
		Pre-monsoon (June-Aug)	Post-monsoon (Dec-Feb)
1.	Lepidoptera	06	02
2.	Coleoptera	03	03
3.	Odonata	03	02
4.	Dictyoptera	01	02
5.	Orthoptera	02	02
6.	Hemiptera	04	05
7.	Hymenoptera	03	04

The avian, reptile and mammalian communities inside the Sathyabama campus are much diversified. First, the avian fauna inside the campus is protected from large habitat degradation and provides them with natural vegetation and plantations. The documentation of birds happened for the first time and the frequent bird counts are undertaken every year. The list of avian fauna available inside the campus has been listed below.

Table 4: List of avian fauna inside the campus

S. No	Family	Scientific name	Common name
	Pelecaniformes		
1.	Ardeidae	<i>Bubulcus ibis</i> (Linnaeus, 1758)	Cattle Egret
2.		<i>Ardea alba</i> Linnaeus, 1758	Great egret
3.		<i>Egretta garzetta</i> (Linnaeus, 1766)	Little Egret
4.		<i>Ardea purpurea</i> (Linnaeus, 1766)	Purple heron
5.		<i>Ardea cinerea</i> Linnaeus, 1758	Grey heron

6.	Pelecanidae	<i>Pelecanus philippensis</i> Gmelin, 1789	Spot billed pelicans
7.		<i>Threskiornis melanocephalus</i> (Latham, 1790)	Black-headed Ibis
8.		<i>Pseudibis papillosa</i> (Temminck, 1824)	Indian Black Ibis
	Suliformes		
9.	Phalacrocoracidae	<i>Microcarbo niger</i> (Vieillot, 1817)	Little cormorant
	Charadriiformes		
10.	Scolopacidae	<i>Numenius phaeopus</i> (Linnaeus, 1758)	Eurasian Whimbrel
11.	Jacaniidae	<i>Hydrophasianus chirurgus</i> (Scopoli, 1786)	Pheasant-tailed Jacana
12.	Charadriidae	<i>Vanellus indicus</i> (Boddaert, 1783)	Red-wattled lapwing
13.	Recurvirostridae	<i>Himantopus himantopus</i> (Linnaeus, 1758)	Black-winged stilt
	Accipitriformes		
14.	Accipitridae	<i>Milvus migrans</i> (Boddaert, 1783)	Black Kite
15.		<i>Haliastur indus</i> (Boddaert, 1783)	Brahminy kite
	Falconiformes		
16.	Falconidae	<i>Falco tinnunculus</i> Linnaeus, 1758	Common kestrel
	Ciconiiformes		
17.	Ciconiidae	<i>Mycteria leucocephala</i> (Pennant, 1769)	Painted stork
18.		<i>Anastomus oscitans</i> (Boddaert, 1783)	Asian open bill stork
	Galliformes		
18.	Phasianidae	<i>Francolinus pondicerianus</i> (Gmelin, 1789)	Grey Francolin
	Gruiformes		
20.	Rallidae	<i>Porphyrio poliocephalus</i> (Latham, 1801)	Grey-headed swamphen
21.		<i>Fulica atra</i> Linnaeus, 1758	Common coot
	Columbiformes		

22.	Columbidae	<i>Columba livia</i> Gmelin, 1789	Rock Dove
23.		<i>Streptopelia chinensis chinensis</i> (Scopoli, 1786)	Spotted Dove
	Psittaciformes		
24.	Psittacidae	<i>Psittacula krameri</i> (Scopoli, 1769)	Rose-ringed Parakeet
	Cuculiformes		
25.	Cuculidae	<i>Centropus sinensis</i> (Stephens, 1815)	Greater Coucal
26.		<i>Eudynamys scolopaceus</i> (Linnaeus, 1758)	Asian Koel
	Strigiformes		
27.	Tytonidae	<i>Tyto alba</i> (Scopoli, 1769)	Barn owl
	Apodiformes		
28.	Apodidae	<i>Cypsiurus balasiensis</i> (J.E. Gray, 1829)	Asian Palm swift
	Coraciiformes		
29.	Alcedinidae	<i>Halcyon smyrnensis</i> (Linnaeus, 1758)	White-throated Kingfisher
30.		<i>Ceryle rudis</i> (Linnaeus, 1758)	Pied Kingfisher
		<i>Alcedo atthis</i> (Linnaeus, 1758)	Common Kingfisher
31.	Meropidae	<i>Merops orientalis</i> Latham, 1801	Asian green bee-eater
	Passeriformes		
32.	Cisticolidae	<i>Orthotomus sutorius</i> (Pennant, 1769)	Common Tailorbird
33.		<i>Prinia socialis</i> Sykes, 1832	Ashy Prinia
34.	Corvidae	<i>Corvus macrorhynchos</i> Wagler, 1827	Large-billed Crow
35.		<i>Corvus splendens</i> Vieillot, 1817	House Crow
36.		<i>Dendrocitta vagabunda</i> (Latham, 1790)	Rufous Treepie

37.	Dicruridae	<i>Dicrurus macrocercus</i> Vieillot, 1817	Black Drongo
38.	Motacillidae	<i>Motacilla maderaspatensis</i> Gmelin, 1789	White-browed wagtail
39.	Leiotrichidae	<i>Argya striata</i> (Dumont, 1823)	Jungle Babbler
40.	Oriolidae	<i>Oriolus riolus</i> Linnaeus, 1758)	Golden Oriole
41.	Monarchidae	<i>Terpsiphone paradisi</i> (Linnaeus, 1758)	India Paradise-flycatcher
42.	Nectariniidae	<i>Leptocoma zeylonica</i> (Linnaeus, 1766)	Purple-rumped sunbird
43.	Passeridae	<i>Passer domesticus</i> (Linnaeus, 1758)	House sparrow
44.	Pycnonotidae	<i>Pycnonotus cafer</i> (Linnaeus, 1766)	Red-vented Bulbul
45.		<i>Pycnonotus jocosus</i> (Linnaeus, 1758)	Red-whiskered bulbul
46.	Sturnidae	<i>Acridotheres tristis</i> (Linnaeus, 1766)	Common myna
47.	Muscicapidae	<i>Copsychus fulicatus</i> (Linnaeus, 1766)	Indian Robin



Fig. 3: List of Aquatic birds taken inside the Sathyabama Campus

Row 1 from left: Pheasant- tailed Jacana and Grey-headed Swamphen.

Row 2 from left: Little cormorant – open wing behavior for drying, Eurasian coot, and Pied Kingfisher in flight.

Row 3 from left: Purple heron and Grey heron.

Row 4 from left: Painted Stork.

The herpetological fauna such as frogs, toads, snakes, geckos, and lizards are less diversified and also not much explored inside the university campus. The common house gecko *Hemidactylus frenatus* Schlegel, 1836 is predominantly available. The oriental garden lizard *Calotes versicolor* (Daudin, 1802) and golden skink *Eutropis carinata* (Schneider, 1801) can be seen commonly in the trees and below the bushes and shrubs. Among snakes, few species of non-venomous snakes such as Indian Rat snake *Ptyas mucosa* (Linnaeus, 1758), Asiatic water snake or Checkered Keelback *Fowlea piscator* (Schneider, 1799), and spotted wolf snake *Lycodon flavomaculatus* Wall, 1907.



Fig. 4: Checkered keelback (non-venomous) snake crossing the street

Step 2: Policy Statement on Alien Species Management :

Safeguarding the Sathyabama campus biodiversity and reduce the ecological impact of alien species, the institution commits to an integrated management framework, which emphasizes prevention, monitoring and awareness. The Eco Club and Biology students and faculty takes preventive measures on prioritizing to preserve the native species in landscaping and restricting the introduction of non-native plants and animals. A structured monitoring system is placed in the institution on implementing to detect invasive organisms in green spaces and water bodies, enabling timely

removal and restoration. The awareness programs for students, faculty and staff helps to understand the allergenicity of alien species and discouraging the release of exotic pets or plants into the environment.

2.2 Wasteland restoration and community garden:

The wasteland around campus was cleared by NSS students and volunteers. Nearly 90 percent of wasteland was occupied by *Lantana* and *Parthenium* weedy plant spp. They were sprayed with 1 percent saline solution and then hand weeded. Further, the land was pulverized to promote soil health and life and planted with native tree species like *Thespesia* spp., *Millettia pinnata*, and *Azadirachta indica* (Fig.1). A part of the wasteland was used for a community garden with planting perennial vegetables like moringa, curry leaf, and seasonal vegetables like okra, tomato, eggplant, and chilies. The tree species and garden were watered periodically with recycled STP water to prevent wilting. Planting of avenue trees like *Delonix regia*, *Terminalia catappa*, and *Cassia fistula* was done to provide an aesthetic value as well as improve carbon sequestration and green space available on campus.

2.2.1 Rescue and restoration of birds and habitats:

Interestingly, in terms of aquatic birds, the ponds available inside the premises of Sathyabama have been refilled frequently with water by the management authorities of Sathyabama during drought conditions. The refilling of birds would replenish the food availability of aquatic birds as well as increase the aquatic vegetation that enhances the settlement, breeding, and egg-laying behavior of birds. In addition, the scientists of the Centre for Climate Change Studies, Sathyabama also involved in the rescue and release of birds on the campus



Fig. 5: Ashy prinia rescued from the crows and maintained by the scientist of Centre for Climate Change Studies

2.3 Step 3: Integrated landscape management on campus and nearby regions:

Integrated landscape management at Sathyabama was to mainly improve the existing agricultural production systems and natural resources in and around the campus. The approach includes providing farm advisory services, crop surveillance, soil and plant health management services. A team of researchers at Sathyabama frequently visits the nearby cropping regions and collects diseased and insect samples for identification followed by recommendations to the farming community. Similarly, the best crop management practices including seasonal cropping pattern, seed varieties, fertilizer recommendation, post-harvest processing, and marketing strategies were advised to the farming community in collaboration with Innovative Agrotech Pvt. Ltd. Also researchers at Centre for Remote Sensing and Geoinformatics, Sathyabama Institute of Science and Technology have mapped the catchment areas for every season, cropping pattern followed in the nearby regions of the campus, rainfall distribution pattern providing data for dissemination to farmers and agriculture department.



Brown planthopper infestation



A. Leaf folder damage



Yellow Mosaic Virus disease in capsicum

Fig. 6: Few pests and diseases frequently observed in the farming regions near Sathyabama campus

3. Future action plan 2020-2025

- Sustained protection and management of the institutional marshy and rangeland ecosystem like soil, land plants, insect community, and water
- Biodiversity monitoring and cataloging of plant and insect species diversity in and around the campus to keep track of the available rare species on campus
- Conservation and protection of existing habitat in the campus with periodic monitoring and sustainable practices
- Integrated plant health management approach to eliminate invasive species and restoring the natural habitat structure
- Strengthening the knowledge to identify and remove the invasive plant and insect species through pamphlets, videos, and recordings
- Focusing on peri-urban agriculture to meet the requirements of hostel and canteen
- Ensuring sustainable food production systems like fertile viable soil, water, bio-control agents, cropping pattern, climate, and energy adopted in the institution owned farmland and nearby regions
- Revitalization of animal husbandry unit associated with the institution ensuring sustained animal proteins like milk and meat for hostel and canteen needs
- Farm extension services like on-farm training, workshops for sustained plant health, and farm products for the nearby farming community
- Access to agriculture farm machinery like the tractor, leveling devices, processing machinery at very low or free of cost for vulnerable nearby farming villages
- With the existing meteorological and agriculture expert team, a "Crop Advisory System" can be formulated for the nearby farming community on weather data, crop pest surveillance, and recommendations.