SHIV NADAR
INSTITUTION OF EMINENCE DEEMED TO BE
UNIVERSITY
DELHI NCR

SUSTAINABLE DEVELOPMENT GOAL 15

Life On Land

Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss.

Overview

Shiv Nadar University is built on a sprawling green campus spread over 300 acres in a rural-urban landscape. It is surrounded by agricultural land on two sides, the wetlands of Bil Akbarur on one side, and the expressway NH 91 on the front. The surrounding landscape has rapidly transformed due to land use and land cover changes brought about by urbanization; however, with its unique location, the campus has made every effort to conserve and grow its rich flora and fauna with thriving ecological diversity and write its unique biodiversity story.

The Global Risks report presented at the World Economic Forum 2023 points out that biodiversity loss is the fourth most severe global risk over the next ten years, behind climate action failure, climate change adaptation, and extreme weather. To preserve and promote the well-being of terrestrial ecosystems, including forests, wetlands, grasslands, and other natural habitats, SDG 15 addresses the critical challenges our ecosystem faces, including deforestation, desertification, biodiversity loss, and land degradation, to name a few.

At Shiv Nadar, we have recorded over 350 plant species, including unique plant species like the Horsetail from the Jurassic era. Over 95 percent of plant diversity on campus possesses medicinal values. Along with ten species of mammals, 65 species of birds, nine species of reptiles, five species of amphibians, and 54 species of butterflies.

This report provides an update on our recent work contributing to SDG 15 through our teaching, research, institutional practices, and partnerships.

Teaching and Learning

All undergraduate students at Shiv Nadar University must take a core group of common subjects designated as the Core Common Curriculum which has Ecology and Environmental Sciences component. Almost every department offers courses on sustainability and has faculty members researching these topics. Two of the priority research areas for the University are environment and energy. Courses such as Environmental Studies (CCC 704), Biodiversity: Assessment & Conservation (CCC 706), and Environmental Impact Assessment (CCC 406), Ecology and Environmental Science (BIO104) inspire students to study biodiversity at the global level and practice it in their local environment.

The university campus is an exciting living lab for faculty, researchers, and students to study, research, and document diverse flora and fauna.

Learning Activities

Flagship Nature Immersion Lab at our biodiverse campus

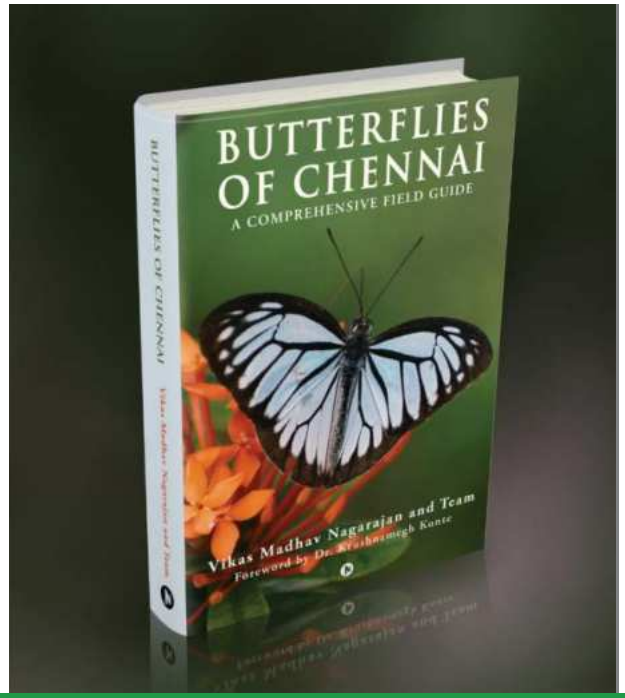
A Unique 5-day residential program was held between January 2-6, 2024 with an exciting range of activities to help school students reconnect with nature and their environment through experiential learning and hours of indelible interaction with eminent faculty and wildlife experts in lessons on sustainability and conversations. Over the five days the group recorded 73 species of birds on campus out of which 13 species were migratory birds from Central Asia.

At Shiv Nadar, we regularly host a **Young Thinkers Forum** that brings together specially curated programs on various themes, from a three-day certificate program for grades 7-12 school students to a week-long residential experimental program. From Masterclasses, weekend programs, and summer and winter schools, school students interact with faculty and experts on diverse disciplines, providing invaluable insights, igniting curiosity, and laying the foundation for informed decision-making. The biodiversity and sustainability program forum introduces concepts of biodiversity, ecology, growing micro-greens, composting, recycling, and sustainable living.

Aditya Ramakrishnan- recognized as one of the top ten naturalists under 26

Aditya Ramakrishnan, a student of B A (Research) in International Relations and Governance, is a nature enthusiast at Shiv Nadar University and has embraced every opportunity to delve into his passion for nature. He is recognized as one of the top ten naturalists under 26, contributing to the book *Butterflies of Chennai: A Comprehensive Field Guide.*

His book provides extensive information on the 157 butterfly species in Chennai, including identifying marks and their habitats.

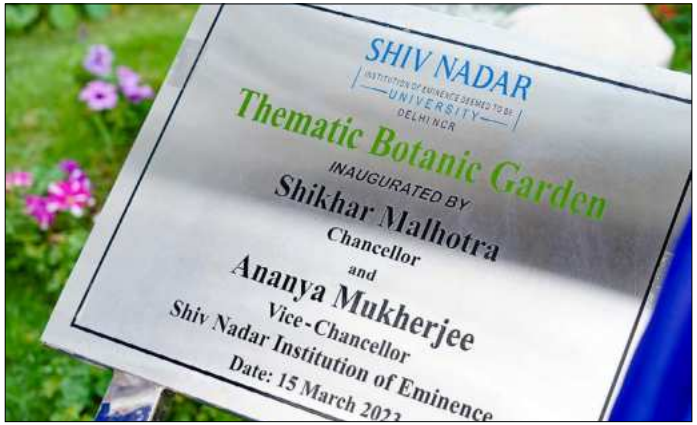


Research

At the University, we have recorded over 350 plant species belonging to 175 genera and 62 families, of which several species are new records for the state of Uttar Pradesh. The campus is also rich in faunal diversity, characterized by a mixture of wetlands and terrestrial species, mammals, aves, reptiles, amphibians, fishes, molluscs, annelids, insects, and 54 species of butterflies. Over 95 percent of plant diversity on campus possesses medicinal values.

The goal of a sustainable campus - a living tribute to our commitment to biodiversity.

On March 15, 2023, we launched the on-campus Shiv Nadar Thematic Botanic Garden, a one-of-a-kind in India with a vision to serve as an excellent resource for learning, research, and conservation. The garden is a visual treat for visitors and an opportunity to connect with nature and learn about the importance of plants and their role in sustaining life on Earth. Spread over an area of 4.2 ha (10.4 acres), the Botanic Garden boasts an impressive collection of over 3,000 plants representing 805 plant species, including varieties from 148 families and 502 genera. The local flora and fauna on campus will play a vital role in preserving native plant species.



Incentivizing endemic biodiversity conservation under a warming climate through market-based instruments

This study investigates the potential of utilizing payment for ecosystem services (PES) led incentives to support the conservation of endemic biodiversity and the development of alternative livelihood opportunities, specifically through ecotourism, in regions facing water scarcity. It highlights the ability of PES programs to not only generate additional income for communities and encourage land use practices that safeguard biodiversity and enhance water recharge. Moreover, when social norms adapt and transform as water availability improves and PES incomes increase, it may promote the emergence of community-driven ecotourism ventures. The study uses the case of the lateritic plateaus in the Konkan region of Maharashtra, India, and designs a dynamic optimization model of the local community's utility maximization problem under land use choices that could provide them with water security and alternative livelihoods through ecotour. The findings indicate that when PES income is substantial, community norms and social enterprises undergo a synergistic transformation, thereby offering livelihood resilience in the context of a warming climate.

Ranjan, Ram. "Incentivizing endemic biodiversity conservation under a warming climate through market-based instruments." *Journal of Environmental Economics and Policy (2023)*: 1-24

Silvicultural Practices in the Management of Diospyros melanoxylon (Tendu) Leaf Production: Options and Trade-offs

Non-timber forest products (NTFPs) are known to provide livelihoods for forest-based communities worldwide. While ensuring the sustainability of NTFP harvests is a crucial challenge, optimizing the production of NTFPs through appropriate silvicultural practices is also critical for forest-based economies. In Central India, the suitability of fire or pruning practices for enhancing the production of leaves of the tendu tree (Diospyros melanoxylon) has been much debated. While villagers commonly adopt annual litter fires, the state Forest Department urges leaf collectors to adopt the more labor-intensive pruning practice. On the other hand, conservationists recommend completely hands-off management (no fire or pruning). In this study, leaf production is compared to the competing practices of litter fire, pruning, pruning-with-fire, and hands-off management that are experimented with in community-managed forests. Confounding factors such as tree canopy cover, presence of tendu trees, and inherent differences in forest type are noted. The study was conducted during the pre-harvest season from March to May 2020 in villages in the northern Gadchiroli district of Maharashtra, India. It was found that pruning and pruning-with-fire lead to higher root sprout production and, in turn, higher leaf production per unit area when compared to litter fire and the control (no pruning or fire). Fire alone led to a negative impact on leaf production. Implementing pruning instead of litter fire, however, comes with labor costs. Its adoption is therefore linked with the institutional arrangements for tendu management and marketing that shape community perception of costs.

Date, Anuja Anil, Ankila J. Hiremath, Atul Arvind Joshi, and Sharachchandra Lele. "Silvicultural practices in the management of Diospyros melanoxylon (Tendu) leaf production: options and trade-offs." Economic Botany 77, no. 2 (2023): 135-152.

Phylogenetics in the Context of Tree Diversity and Conservation

Phylogenetics has been pivotal in enabling biological sciences more relevant to life and life forms since the 1980s. In the last two decades, omics have also transformed phylogenetics. The chapter in the book discusses the general outlook of phylogenetic-based biodiversity conservation and common methods, followed by the status report on the application of phylogenetics in forestry. It concludes that phylogeny methodology coupled with broad sampling in tropical forests will facilitate obtaining detailed biodiversity information at the local scale where conservation efforts can be focused.

Rajarajan, Kunasekaran, Raju Vishnu, Emayavaramban Priyadarshini, Prithvi Arunachalam, and Subramanian Suresh Ramanan. "Phylogenetics in the Context of Tree Diversity and Conservation." In *Molecular Genetics and Genomics Tools in Biodiversity Conservation*, pp. 17-30. Singapore: Springer Nature Singapore, 2022.

Effect of forest fire on tree diversity and regeneration in the forests of Uttarakhand, Western Himalaya, India

This study aimed to investigate the impact of forest fires on tree diversity and their regeneration in three fire-prone forests of Uttarakhand, India. The study used Landsat 5, 7, and 8 satellite imagery to prepare fire frequency maps and divided the study area into four fire frequency classes. Ten plots were marked in each fire frequency class to assess tree species' diversity and regeneration pattern. Fourteen tree species belonging to 14 genera and 13 families were sampled during the study period. The study found that the tree species diversity was higher in areas with low fire frequencies in comparison to the areas with no fire frequency class; regeneration of tree species varied significantly across all fire frequency classes and forest types, with the increasing dominance of certain fire-tolerant species in areas with frequent fires. The study suggests that if forest fire incidences continue at current levels, the forests could experience a decline in tree diversity.

Bargali, Himanshu, Dinesh Bhatt, Rakesh Chandra Sundriyal, Virendra Pratap Uniyal, Aseesh Pandey, and Ram Ranjan. "Effect of forest fire on tree diversity and regeneration in the forests of Uttarakhand, Western Himalaya, India." *Frontiers in Forests and Global Change 6* (2023): 1198143.

Folk Art - A Powerful Tool for Explaining Biodiversity

Folk art can be a powerful tool for communicating complex scientific ideas. At Shiv Nadar University, a team of faculty, staff, and students has created a unique map to visually communicate the rich flora and fauna of campus using the traditional art form. Conceptualized by Dr. Bahar Dutt, Associate Professor, Department of Art, Media and Performance, and created by artist Sudarshan Shaw, who used folk art to create a biodiversity map. This map was featured in Scientific American, capturing the richness of the campus biodiversity using Indian folk art and bringing together disciplines of Ecology, Communications, and Art. Created using Mughal-style art, the map depicts the university's faunal diversity, including ten species of mammals, 65 species of birds, nine species of reptiles, five species of amphibians, and 27 species of Butterflies in and around the campus. The map is installed all over campus to educate and create a sense of pride in the university's ecosystem, which is more than the built environment.

Ms. Bahar Dutt wins the prestigious AAAS Kavli Science Journalism Award.

Ms. Bahar Dutt, Associate Professor at the School of Humanities and Social Sciences, won the prestigious American Association for the Advancement of Science (AAAS) Kavli Science Journalism Award. She bagged the silver award for 2023 for her report on 'Science in Action: Saving the Bhimanama.'

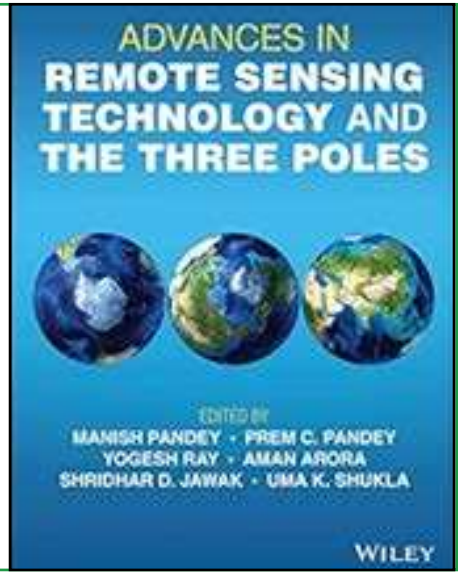
In her 11-minute report, she followed biologist Ayushi Jain on a quest to save the Asian giant softshell turtle, once found across South and East Asia and today on the edge of extinction.

Books published

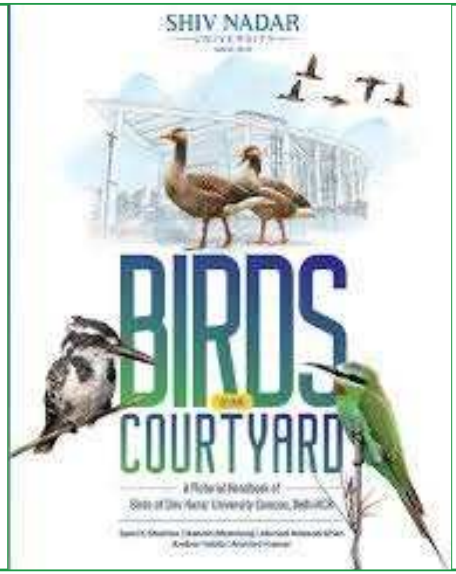
Advances in Remote Sensing Technology and the Three Poles

The book's overall concept describes the role of distinctly separate three poles and three polar regions (TPRs) in the planet's functioning as a system through various positive and negative feedback loops. It argues that the Earth as a system is connected through different pathways to its various spheres, such as the geosphere, lithosphere, hydrosphere, atmosphere, biosphere, and the latest one, the anthroposphere.

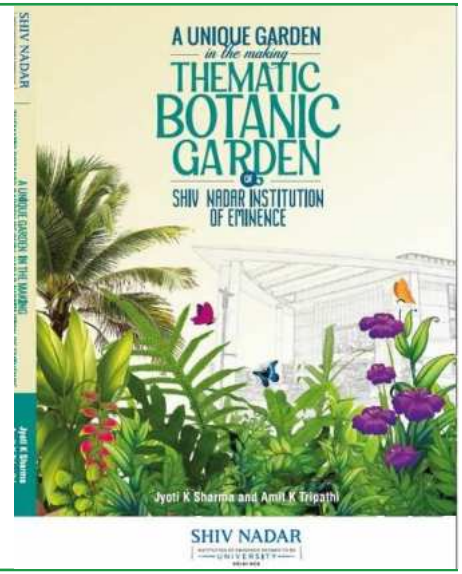
Pandey, M., Pandey, PC., Jawak, Shridhar D., Arora, A., Ray, Y & Shukla, U.K., (2023) Advancements in Remote Sensing Technology and The Three Poles: A Multidisciplinary Approach to The Study of The Arctic, The Antarctic and The Himalayas" John Wiley & Sons Ltd., ISBN-9781119787723



Jyoti K Sharma, Manish Bhardwaj, Ahmad Masood Khan, Amber Habib, and Aravind Kumar. 2022. Birds of Our Courtyard: A Pictorial Handbook of Birds of Shiv Nadar University Campus. Shiv Nadar University. 416 Pages (In Print)

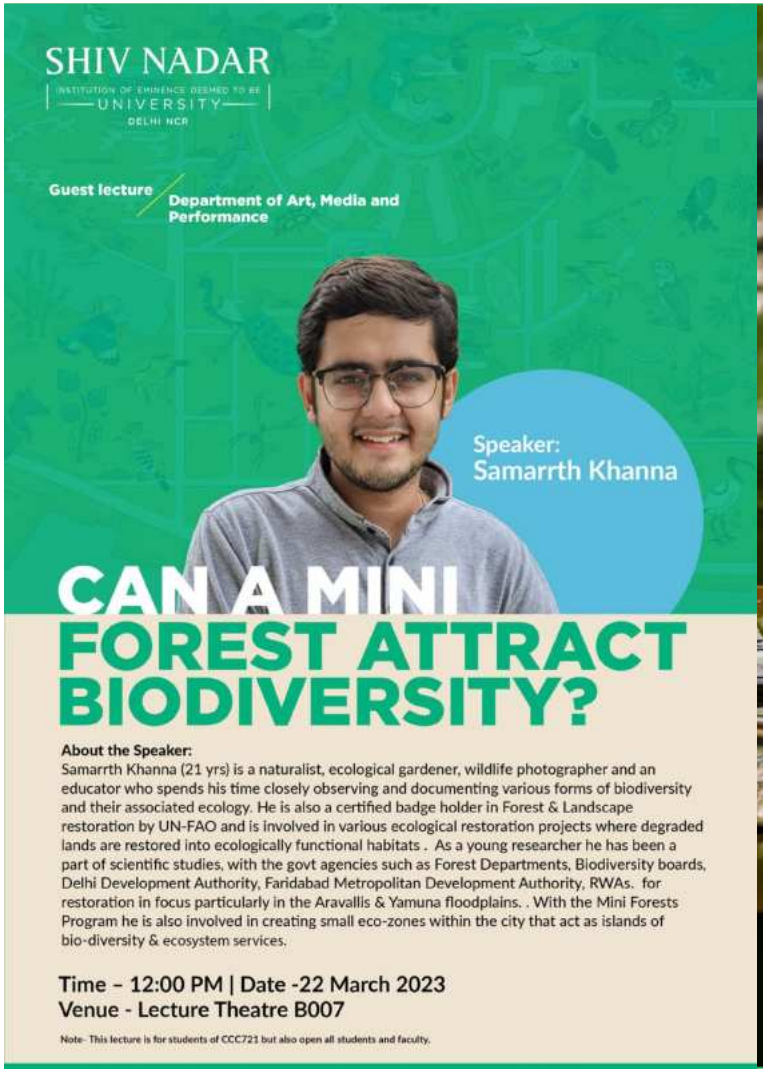


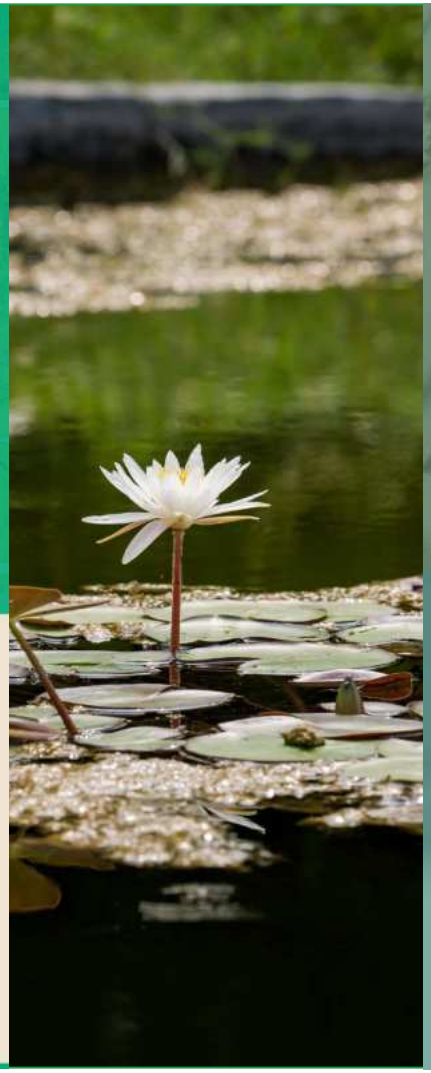
Jyoti K Sharma and Amit K Tripathi 2023. A Unique Garden in the Making: Thematic Botanic Garden of Shiv Nadar Institution of Eminence. Published by Shiv Nadar Institution of Eminence, Delhi-NCR, pp. 257. ISBN: 978-81-962278-0-7.

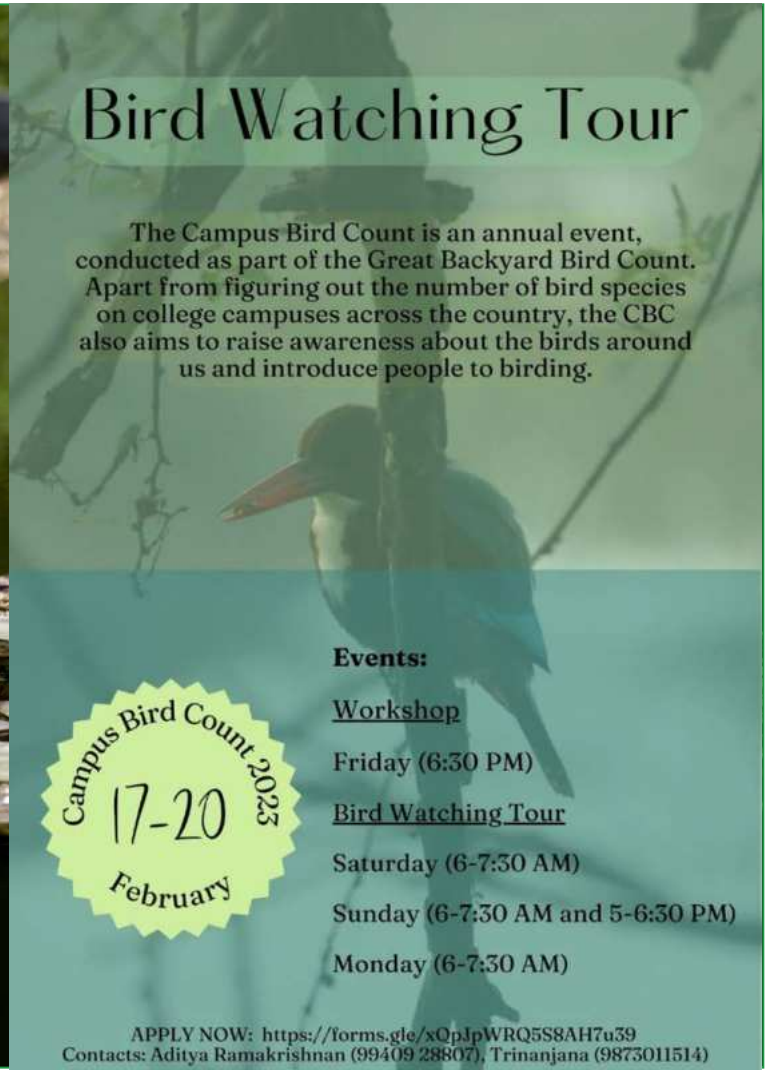


Conversations on Campus

Our university campus is filled with some incredible biodiversity. The bird life is especially rich, and over 150 species have been recorded in the immediate surroundings. To explore the species of birds on campus, we organize workshops and nature walks to spot and observe the feathered friends of Shiv Nadar University and contribute to the campus bird count.







University Operations

Botanic Garden on Campus

The University is proud to host and develop a thematic botanic garden[1] in an area of 10.4 acres. About one-fourth of the area adjacent to the boundary is part of the Bil Akbarpur wetlands, where the natural population of equisetum[2]. is conserved.

The botanic garden is a collection, cultivation, and display of a wide range of plants labeled with their botanical names for scientific study. It shows to the public for general awareness and has helped in the ex-situ conservation of valuable plant diversity. The thematic botanic garden has 11 theme gardens of about 555 plant species: Medicinal Plant Gardens; RET Plant Gardens; Palm Gardens; Gymnosperms Garden; Ficus Garden; Hydrophytes Garden; Butterfly Garden; Bamboo Garden; Fruit Plant Garden; Species and Condiments Garden; Xerophytes Garden. The first of its kind in Northern India, the garden is conceptualized and established to increase awareness about various plants and conserve them in their unique germplasm for education and research.

1. Thematic botanic garden is a unique concept where cultivated and wild plants of economic importance and those vulnerable from the conservation point of view are grouped together based on their uses or taxonomic groups

2. Equisetum is one of the oldest living genera of vascular plants and is the sole living representative of a large and ancient group of Equisetales, which inhabited the Earth during Jurassic period. The Botanical Garden has a natural population of Equisetum ramosissimum, a living fossil species which is being conserved in the wetland part of the Garden.

The wetland side of the botanic garden provides a conservatory for the oldest known living genera of vascular plants. These are two species of Equisetum (also known as horsetail), i.e., Equisetum ramossisimum ramossisimum and Equisetum ramossisimum devil, living fossils from the Jurassic time. All species in and around the garden are indigenous or endemic, except for a few. The main thrust is to introduce as many rare, endangered, and threatened plant species from the point of view of conservation.

Geo Tagging of Campus's rich plant life in progress

In a drive to geo-tag trees on campus, we have carried out inventorisation of and affixing QR codes on 13500 trees with 44 individual species present within the boundary of Shiv Nadar University using the census method. More than 20 primary and secondary attributes have been recorded for each of these trees, including Latitude and Longitude, Local Name, Girth, Height, Condition, and Canopy Diameter, to name a few. Special Remarks (Mechanically cut)

Today, 13500 trees have been assigned a specific QR code, which, when scanned, gives detailed information about the tree.

Importance of Tree Data at Shiv Nadar University

- Access to the tree data, including the mapping feature.
- Students access information about each tree on their mobile device by scanning the QR code.
- Helps improve tree identification skills, including awareness, information, and conservation trees, which is also used for research
- Identify gaps using a GIS map layer and maintain data of cut / collapsed/ illegal cut trees, etc.
- Most significantly, it is helpful in carbon sequestration on the campus.

Landscaping the Campus

The university has beautifully landscaped gardens, tree avenues, and sprawling grassy areas developed and planned by a horticulture architect. The University takes pride in the extensive horticultural work and tree plantation drive carried out during the past few years, increasing the tree cover and overall greenery on campus. To date, we have the following ground cover:

S.NO	PARTICULARS	TOTAL QUANTITY
1	Trees/Palms	13169
2	Shrubs	167736
3	Ground Covers	297963
4	Grass	339439 sqm.

To conserve the wild native species present on campus, maintain the healthy ecosystem of the campus, and prevent the growth of invasive species, the biodiversity core team on campus, comprising faculty and trained local farmers, makes every effort to enhance knowledge of and preserve the area's biodiversity. During every development process on campus, every aspect of biodiversity is considered. So, every measure is taken not to remove old or native trees planted previously.

Story of Hemraj, a trained local gardener

The botanic garden provides the chance to see fruit plants, including almonds, apples, avocados, dragon fruit, peach, plum, loquat, orange malta, and walnuts, to name a few. The experience of walking in the garden is enhanced manifold by the trained local gardeners who fill us in with all the local information and significance of each plant. One such name is Hemraj, who has worked on campus since its inception. Today, he takes pride in his local knowledge and has enthusiastically learned the science behind the botanical garden, caring for 700 plant species. For many of our visitors, Hemraj's knowledge of the garden is a treat, and we refer to him as the wind beneath the wings of the garden.

Date Palm Grove

A unique feature of the Shiv Nadar IoE campus is that it is dotted with several Date Palm trees, either individually or in groups. The largest date palm grove, also known as the Sacred Grove, comprises more than 900 individual dates Palm trees. It covers an area of 0.75 hectares on the eastern side, located near the Dargah on the road from the indoor sports complex.

According to the elders[1] of the Chithera Village, the trees are 300-400 years old. The area has relics from Mughal invaders; some say nomads from the West camped here in the wetlands. The date palm seeds they left along their camping trail later grew into date palm trees spread across North India, including the University campus and the surrounding areas. Forming a unique ecosystem, the date palm grove is an essential keystone species, providing shelter, habitat, and food to several wild plants and animals. Some plant species found in the sacred grove include Vasaca, Ratti, and Sandpaper plants that are no longer found outside in western UP.

1. A village elder is person having authority because of age and experience

The Campus Lake

The campus lake is part of the Dadri wetlands, also called the Bil Akbarpur wildlife habitat. The lake was almost dried up when the University was founded. Its immediate revival has allowed many fish and aquatic plants to thrive, such as Nitella, Chara, and other phytoplanktons, which provide food for winged visitors. Alternanthera philoxeroides grows gregariously throughout the year on the lakes' fringes, encroaching on the water body and offering a good insect population to feed the birds.

The lake is home to many species of birds, which are endangered, near threatened, or vulnerable in the IUCN category, including the common Pochard, Sarus Crane, Woolly-necked Stork, Ferruginous Duck, Painted Stork, Black-headed Ibis, Black-necked Stork, Oriental Darter, Alexandrine Parakeet, and Egyptian Vulture. All efforts are being taken to preserve the lake and its natural ecosystem. During summers, the lake is supported by external water to preserve life underwater, and the water is conserved and rejuvenated through rainwater harvesting. Efforts are being made to focus on migratory avifauna which visit the lake. True to its existence on the campus, the University named its first newsletter after one of the prominent resident birds, the Whistling Teal.

Partnerships

The School of Humanities and Social Sciences (SHSS), in collaboration with The Habitat Trust (THT), has undertaken two exciting projects.

1. Conservation of Alluvial Grasslands in the Dudhwa – Pilibhit Landscape

The alluvial grasslands of India are one of India's most threatened ecosystems. Besides wild spaces and forests, a large portion of the Indian subcontinent is covered by grassland ecosystems. The Terai alluvial grasslands are one of the country's most biodiverse regions. Other than Assam, Uttar Pradesh has one of the largest belts of Terai grasslands. Unfortunately, because Uttar Pradesh has the highest human population in India, land pressure has taken away most of these amazing grasslands in the form of agriculture. With the severe loss of grasslands throughout the state, most of these grasslands now exist only in the Protected Areas (PA) of the Dudhwa and Pilibhit Tiger Reserves and the river banks that flow around these areas. The communities living around this area depend highly on these grasslands. Shiv Nadar IoE, in collaboration with THT, aims to look at the impact of communities on these habitats and work towards developing economic interventions that will help reduce the dependence of these communities on the forests and nudge a positive mindset toward the forests and its denizens for long-term conservation.

2. Conservation of Rocky Outcrops

The Konkan region of Maharashtra has mid-elevation lateritic plateaus between the Sahyadris and the coastal plain. Apart from India, such lateritic plateaus are highly restricted ecosystems found only in Brazil and Australia. These rocky outcrops are home to a wide range of endemic plants, amphibians, and a multitude of other taxa and historical petroglyphs[1] . Being under threat due to private ownership, outcrops face significant challenges due to laterite mining, mango, and cashew plantations and selling these properties for various purposes. A team from SHSS, in collaboration with THT, has conducted a pilot study to assess the prospects of developing economic opportunities for the communities, which will help them retain the rocky outcrops and contribute to their conservation.

1. Petroglyphs are images of animals and people, as well as structures, formed by picking or removing the upper surface of a rock.

3. National Milk Day Celebration

National Milk Day was celebrated on November 26, 2023, to commemorate the efforts of Dr. Verghese Kurien, the brain behind the White Revolution in India. Dr. Kurien played an instrumental role in developing the dairy industry in India. His efforts also made India self-sufficient as far as its dairy needs were concerned. The university partnered with Amul for National Milk Day, and a tree plantation drive was organized on campus. Students, faculty, and staff, along with the representatives from Amul, participated in the drive.

4. Adoption of green areas in collaboration with local agency

Shiv Nadar University continues to take care of its adopted green areas agreed upon under a Memorandum of Understanding (MoU) signed with the Greater Noida Industrial Development Authority (GNIDA) on June 2, 2019. Under this MoU, the University has agreed to adopt the green area on behalf of GNIDA. This area is called Veer Savarkar Chowk. Since then, we have developed and maintained the green area, cultivating flower beds, trees, shrubs, and community gardens. Besides, we have regularly maintained the area by raking leaves, picking up litter, removing graffiti, pulling weeds, and bearing the total cost of this maintenance. To date, we have planted 160 trees, 1107 shrubs, and 575 sqm of grass with a survival rate of 95%.

Shiv Nadar Institution of Eminence is fully committed to the UN Sustainable Development Goals (SDGs). We have embraced a four-pronged strategy for SDGs through **teaching, research, our core institutional practices, and partnerships.**

Deepa Hazrati
Sr. Manager, Office of the Vice-Chancellor
deepa.hazrati@snu.edu.in

Shiv Nadar Institution of Eminence
Gautam Buddha Nagar, Uttar Pradesh, India