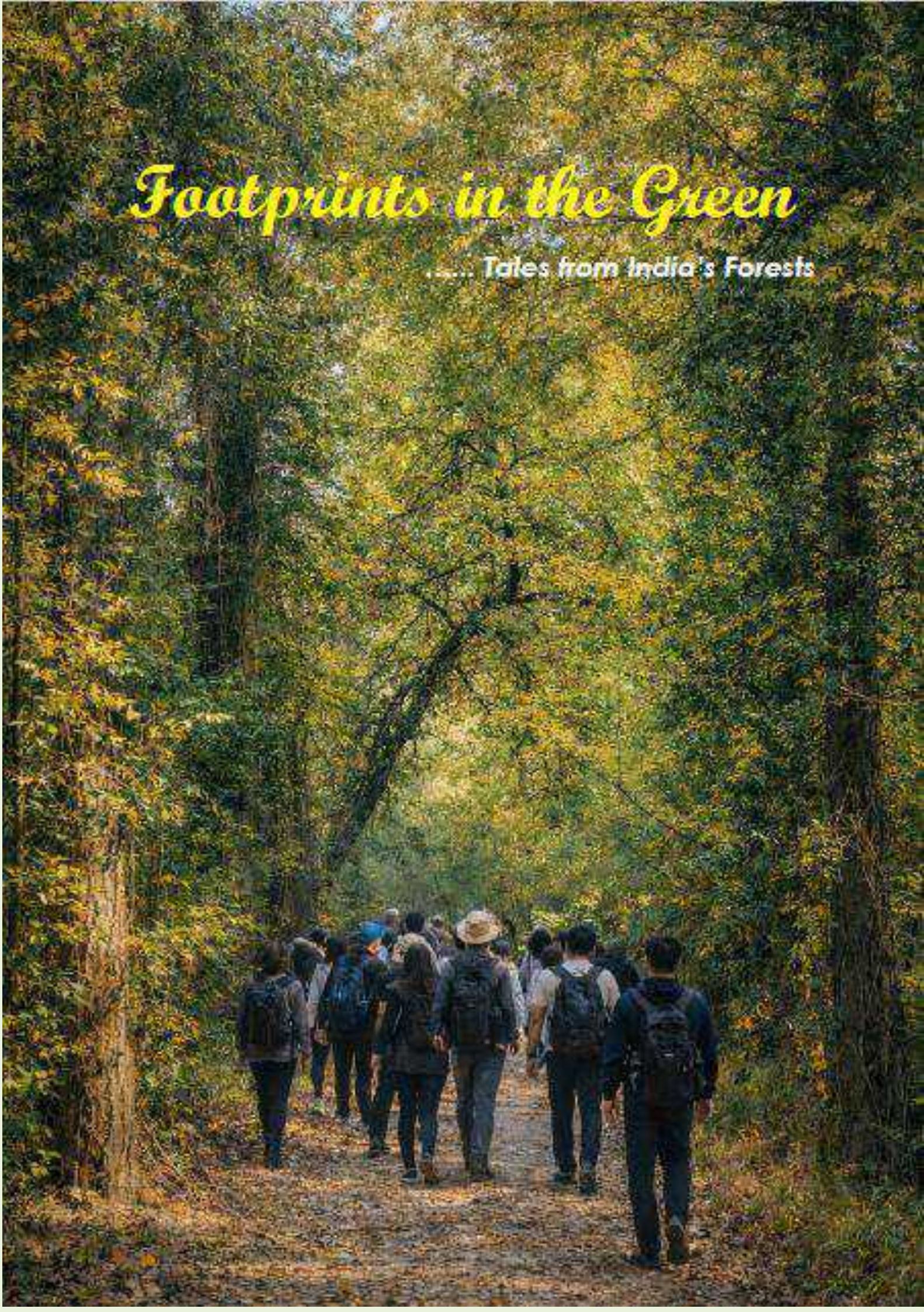
Footprints in the Green
..... Tales from India's Forests

Footprints in the Green

Tales from India's Forests

A Chronicle from the Edge of the Indian Wilderness

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11th Batch (2024-2025)

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Director's Message.....

It is a matter of great pride and immense satisfaction to place before the readers "***Footprints in the Green: Tales from India's Forests***" a reflective compilation that captures the experiences and learnings of the 11th Batch Forest Range Officer Trainees of the Telangana State Forest Academy. This document chronicles the insights gained during their all-India Study Tour, which forms an integral component of professional forestry training.

The all-India Study Tour forms a vital component of professional forestry training, offering trainees an opportunity to witness the extraordinary ecological diversity of our country beyond textbooks and classrooms. During this journey, the trainees were exposed to a wide range of ecosystems—mangrove forests, the Western Ghats, marine ecosystems, mountain landscapes, and the unique shola forests—each presenting distinct ecological processes, conservation challenges, and management practices.

These firsthand experiences have enabled the trainees to understand the interconnectedness of ecosystems, the complexities of biodiversity conservation, and the practical realities of forest governance across varied geographic and socio-ecological settings. The narratives captured in this volume reflect not only their observations and technical learnings, but also their growing sensitivity towards nature, people, and sustainable resource management.

I am confident that ***Footprints in the Green: Tales from India's Forests*** will inspire future batches, enrich institutional learning, and contribute meaningfully to the professional growth of young forest officers dedicated to the stewardship of India's forests.

(Dr. S. J. Asha, IFS)
Chief Conservator of Forests & Director
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Dulapally, Hyderaba

PREFACE

It gives me immense pleasure to present this compilation of learnings and experiences of the 11th Batch Forest Range Officer Trainees of the Telangana State Forest Academy, documented during their all-India Study Tour, an integral component of the induction training programme. This tour provided the trainees with a unique opportunity to complement classroom learning with firsthand exposure to the diverse forest ecosystems of our country.

The all-India Tour enabled the trainees to observe and understand the ecological, climatic, and managerial variations across regions. Their journey through mangroves, the Western Ghats, marine ecosystems, mountainous landscapes, and shola forests offered valuable insights into ecosystem dynamics, biodiversity conservation, and region-specific forest management practices. Such experiential learning is essential in shaping well-rounded forest officers capable of addressing complex environmental challenges.

What makes this endeavour noteworthy is the sincerity and curiosity with which the trainees approached each landscape. They engaged with field officers, interacted with local communities, and reflected on the practical aspects of conservation, protection, and sustainable resource use. The learnings recorded in this document reflect not only technical understanding but also the development of professional ethics and ecological sensitivity.

As Course Director, I appreciate the dedication, discipline, and teamwork demonstrated by the trainees in documenting their observations. I am confident that this compilation will serve as a valuable learning resource for future batches and strengthen institutional knowledge. I congratulate the 11th Batch trainees for their commitment and wish them success as they carry forward these lessons into their professional careers in forest service.

(B. Venkateswar Rao, DCF)
Course Director (11th Batch FRO ITP)
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ACKNOWLEDGMENT

We express our sincere gratitude to the Telangana State Forest Academy for providing us with the opportunity to participate in the “All India Study Tour”, which has been an immensely enriching and educative experience. We are deeply thankful to the Director, Additional Director, Joint Director, Deputy Directors, Forest Range Officers, Course Director & Assistant Course Director of the Academy for their guidance, encouragement, and meticulous planning that made this journey both meaningful and successful.

We gratefully acknowledge the cooperation and support extended by the officers and staff of the various State Forest Departments, research institutions, and allied organizations across the country. Their willingness to share practical knowledge, field experience, and insights greatly enhanced our understanding of diverse forest ecosystems, management practices, and conservation challenges.

We also extend our appreciation to all the resource persons, and field staff for their efforts and hospitality during our visits. Finally, we thank our fellow trainees for their teamwork, cooperation, and shared learning, which made this journey memorable and rewarding. This book is a collective outcome of the experiences, observations, and knowledge gained during the “Bharat Darshan Study Tour”.

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A Comparative Study of High-Altitude Zoos of India: Field Learnings from All-India Tour

Daisy Baishya
Roll No: 05

During our All-India Tour, we had the opportunity to visit four major high-altitude zoological parks of India—Himalayan Nature Park, Kufri (Himachal Pradesh), Sikkim Himalayan Zoological Park (Gangtok), Padmaja Naidu Himalayan Zoological Park (Darjeeling, West Bengal), and Pt. Govind Ballabh Pant High Altitude Zoo, Nainital (Uttarakhand). Visiting these zoos as part of a professional learning exercise allowed us to closely observe their functioning, management practices and conservation approaches. Although all four zoos are located in Himalayan regions and primarily focus on cold-climate fauna, we found several similarities as well as significant differences in terms of altitude, enclosure size, species composition, use of technology and overall conservation strategy.

The Himalayan Nature Park at Kufri, situated at around 2,600 metres above sea level, represents the western Himalayan ecosystem. Spread over nearly 90 hectares, the park emphasizes large, open and naturalistic enclosures integrated into existing forest cover. The primary focus here is on native Himalayan herbivores and carnivores such as Himalayan tahr, goral, musk deer, barking deer, black bear and pheasants. Technological interventions are minimal, with greater reliance on natural climate, terrain and vegetation. Management practices focus on low-stress environments, natural behaviour and soft release concepts, making the park closer to a conservation landscape than a traditional zoo.

The Sikkim Himalayan Zoological Park, located near Gangtok at elevations ranging from about 1,780 to over 2,000 metres, is the largest among the four, covering more than 200 hectares. This zoo follows a modern “zoo-in-the-forest” concept, where animals such as red panda, Himalayan black bear, clouded leopard, Tibetan wolf and yak are housed in extensive semi-wild enclosures. Advanced enclosure planning, remote viewing points, minimal fencing, and habitat-based barriers are key features. Technology is used mainly for

monitoring, surveillance and visitor management rather than climate control, as the natural environment itself is suitable for most species. The park demonstrates how landscape-level planning can support conservation education and animal welfare simultaneously.

The Padmaja Naidu Himalayan Zoological Park at Darjeeling, located at around 2,100–2,150 metres and spread over about 27 hectares, stands out for its strong conservation and scientific orientation. Despite its relatively smaller size, it is a nationally and internationally recognized centre for captive breeding of endangered high-altitude species such as the snow leopard, red panda and Himalayan wolf. The zoo uses specialized breeding enclosures, veterinary support systems, controlled diets and scientific record-keeping. One of its most advanced technological initiatives is the establishment of a "frozen zoo" for genetic material preservation, highlighting its role in long-term species conservation beyond display.

The Pt. Govind Ballabh Pant High Altitude Zoo at Nainital, situated at approximately 2,100 metres and covering only about 4.6 hectares, is the most compact of the four. Due to its limited area and proximity to human settlements, greater use of technology is evident. For instance, the zoo uses heat blowers and temperature-management systems for animals during extreme cold conditions, especially for species requiring controlled microclimates. Enclosures are more structured, with night shelters, heating arrangements and close veterinary supervision. Species such as snow leopard, Himalayan black bear, Tibetan wolf, sambar and high-altitude pheasants are maintained with a strong emphasis on animal care, education and visitor awareness.

In conclusion, visiting these four high-altitude zoos provided valuable professional learning from the perspective of a Range Forest Officer. The tour highlighted how altitude, climate, available space and regional priorities influence zoo design and management. We learned that successful conservation does not follow a single model—large landscape-based parks like Sikkim and Kufri rely on natural habitats, while compact zoos like Nainital depend more on technological interventions. Darjeeling Zoo demonstrated the

importance of scientific research, captive breeding and genetic conservation. Overall, these visits reinforced the need for adaptive management, species-specific care, and the integration of technology with ecological principles to strengthen wildlife conservation in India's fragile Himalayan regions.

Fig. Red Panda sighted at Sikkim Zoo

Fig. Male silver pheasant sighted at Padmajanaidu zoological park, Darjeeling

Fig. At entrance of Kufri zoo

Fig. G.B. Pant High Altitude Zoo

A Marine Jewel: Reflections from the Gulf of Mannar

Sarjahan Ahmed

Roll No.: 33

The year 2024 marked a pivotal phase in our journey as probationer Forest Range Officers at the Telangana State Forest Academy. Amidst the rigours of training, the month of October brought with it the much-anticipated South India Tour: a practical immersion into the diverse forest ecosystems of the southern peninsula. While the forests on land offered invaluable lessons in ecology and management, it was our visit to the Gulf of Mannar Marine National Park (GoMMNP) that truly opened our eyes to the complexities and unparalleled beauty of the marine world, a domain often less explored by the terrestrial forester.

Our visit into this spectacular ecosystem was strategically planned as we made our return journey from the sacred land of Rameshwaram. The National Park is an integral part of India's first Biosphere Reserve and consists of a chain of 21 small islands (islets) and the adjacent coral reefs stretching between Thoothukudi and Dhanushkodi.

Encountering the Guardians of the Blue

Our visit was significantly enriched by an interaction with the National Park's Range Officer and staff. Her dedication to this fragile marine habitat was palpable, and her insights into its unique biodiversity provided the analytical framework that we, as future forest administrators, were seeking.

She eloquently described the Park as an ecological treasure trove, boasting a diverse array of coastal ecosystems: *coral reefs, seagrass beds, and mangroves*. This confluence of three critical habitats is what makes the Gulf of Mannar

one of the richest marine biodiversity hotspots globally. The conversation naturally gravitated towards some of the most spectacular, yet vulnerable, species.

- ***Corals (The Underwater Architects):*** The Range Officer emphasised the astounding diversity of over 117 species of hard corals, often referred to as the 'Rainforests of the Sea'. She explained how the coral reefs, mostly fringing and patch reefs, provide the essential structural foundation and nursery grounds for thousands of other marine species. From a conservation standpoint, she highlighted the constant threats: coral mining (now largely controlled), pollution, and the looming crisis of coral bleaching due to rising sea temperatures. The Forest Department's role here is highly technical, involving not just protection but active restoration through coral transplantation using substrates - a commendable blend of research and hands-on conservation efforts.
- ***Dugongs (The Gentle Sea Cows):*** The Dugong, a vulnerable marine mammal, is the flagship species of the park, depending heavily on the seagrass beds for food. Its declining population, she noted, is a key indicator of the health of the seagrass ecosystem. The government of Tamil Nadu, in a landmark decision, has established India's first Dugong Conservation Reserve in the Palk Bay and Gulf of Mannar area, underscoring the high priority placed on this species under the Forest and Wildlife Department's purview.

- ***Sea Horses***: We were fascinated to learn about the presence of the delicate Sea Horse, protected under Schedule I of the Wildlife Protection Act, 1972. Their conservation requires stringent checks on illegal fishing, as they are often caught as bycatch or for the ornamental fish trade. This requires relentless sea-patrolling and community engagement to ensure the enforcement of protective legislation.

The Critical Role of Seagrass and Regeneration

The Range Officer explained that seagrass beds are not merely a food source for the Dugong and sea turtles, but are vital for coastal protection, nutrient cycling, and acting as carbon sinks. They are the '*underwater grasslands*.

She elaborated on the proactive steps taken by the Forest Department and the Gulf of Mannar Biosphere Reserve Trust (GoMBRT) towards restoration. Degradation caused by destructive fishing practices (like bottom trawling) and natural factors is being countered by manual transplantation of seagrass sprigs (shoots) in degraded patches. The success stories of increased cover and recovery of associated fish and macrofaunal density are a testament to the department's commitment to ecological engineering.

Sustainable Ecotourism: A Conservation Tool

The Range Officer stressed that the Forest Department views ecotourism not as a revenue stream, but as a powerful conservation tool.

The practice here is rigorously controlled and community-based. This model involves:

- ***Limited Access***: Only a few islands, like Krusadai Island, are open for regulated tourism.
- ***Community Involvement***: Local fisherfolk are trained and employed as guides and boat operators, providing them with alternative, sustainable livelihoods and incentivising them to protect the resource.
- ***No-Plastic Policy & Interpretation***: Strict enforcement of plastic bans and the use of the Marine Interpretation Centre on Krusadai Island for environmental education ensure that visitors leave with a deeper appreciation and zero ecological footprint.

A Boat Ride and a Personal Connection

The climax of our visit was a memorable boat ride to Krusadai Island. Under the crisp October sun, the waters of the Gulf sparkled in shades of emerald and sapphire. The journey, navigated by a local guide employed through the ecotourism initiative, was breath-taking.

A crucial part of our training involves developing a comprehensive herbarium, and our trip offered a unique chance to collect samples from the coastal ecosystem. We collected leaves of important mangrove species like *Rhizophora mucronata* and *Avicennia marina* from the island's periphery. The feeling of carefully pressing these salt-tolerant plants was a personal moment of connection with this incredible marine reserve.

Conclusion: Lessons for a Forest Officer

The visit to the Gulf of Mannar Marine National Park was far more than a sightseeing tour; it was a foundational lesson in holistic resource management. It underscored the critical principle that conservation knows no boundaries: it extends seamlessly from the deepest terrestrial forests to the vast marine territories.

The Park's success story, as articulated by the Range Officer, is a powerful validation of the Forest Department's expanding role as protector of the nature. From actively restoring coral reefs and seagrass to protecting the magnificent Dugong, the strategies employed here are a masterclass in dynamic conservation. As we prepare to take on the mantle of Forest Range Officers, this experience provides us with a broader perspective and a renewed commitment to the diverse and fragile ecosystems of India, both green and blue. The memory of the turquoise waters of Krusadai Island and the gentle wisdom of its dedicated guardians will undoubtedly inspire our service in the years to come.

A Visit to the Glory of Allapalli: Reflections from a Range Forest Officer Trainee

Daisy Baishya
Roll No: 05

On 11 July 2025, as part of my Central West India tour, I had the privilege of visiting the *Glory of Allapalli*, a six-hectare patch of pristine forest located in the Gadchiroli district of Maharashtra. Despite its modest size, this forest stands tall—both literally and symbolically—as a testament to India's long-standing tradition of conservation and respect for nature.

Declared the first Biodiversity Heritage Site (BHS) in Maharashtra under the Biological Diversity Act, 2002, the Glory of Allapalli holds immense ecological, historical, and cultural significance. Though the Maharashtra State Biodiversity Board cleared its heritage status as early as March 2013, the formal notification issued on 21 May marked a long-awaited recognition of its value. Walking through this forest as a Range Forest Officer, I felt a deep sense of responsibility and pride in being connected to its ongoing protection.

A Living Legacy of Conservation

What makes the Glory of Allapalli truly remarkable is its continuity of protection. The site was first identified for conservation as early as 1867 by British forest officials—an unusually early acknowledgment of biodiversity value. In 1953, a clearly demarcated six-hectare patch was afforded strict protection from grazing, fire, and other anthropogenic pressures. This foresight has allowed the forest to retain its original character as an old-growth teak ecosystem.

Standing beneath the towering teak trees, some of which reach nearly 40 metres in height with girths exceeding five metres, one cannot help but feel humbled. These trees are not merely timber resources; they are living archives of ecological stability. Their presence reflects decades of undisturbed growth—something increasingly rare in today's fragmented landscapes.

Rich Biodiversity in a Small Space

Despite its limited area, the Glory of Allapalli supports extraordinary biodiversity. To date, around 130 floral species have been recorded here, including trees, shrubs, climbers, herbs, and grasses. Such diversity within a compact area underscores the importance of microhabitats and strict protection regimes. For a forest officer, this site serves as a textbook example of how focused conservation can yield long-term ecological dividends.

People, Forests, and Coexistence

The forest lies within a landscape inhabited by the Madia tribe, one of Maharashtra's most marginalized indigenous communities. The surrounding forests are integral to their livelihood, culture, and identity. While the heritage patch itself remains inviolate, the broader forest matrix demonstrates a delicate balance between conservation and sustainable use.

From a conservation perspective, Glory of Allapalli teaches us that biodiversity protection is not solely dependent on large landscapes; well-preserved micro-sites can play a crucial role in maintaining genetic diversity, serving as reference ecosystems, and supporting broader forest health. Glory of Allapalli stands as a living example that dedicated protection, scientific understanding, and people-centric management can ensure the survival of biodiversity.

Fig. At the entry point of Glory of Allapalli

Fig. Tree no-1500, Girth-4.72m, compartment no-76 Glory of Allapalli

Arogya Van: From a Healing Garden in Gujarat to a Vision for Assam

Niharika Gogoi
Roll No: 22

Some journeys quietly stay with us long after they end. My visit to Arogya Van in Gujarat during our West-central India tour was one such experience which is gentle, enriching, and deeply thought-provoking. What began as a simple tour soon unfolded into a deeper understanding of how nature, health, and traditional wisdom can come together in harmony. Located in a serene setting, Arogya Van in Gujarat has been developed as a thematic medicinal garden dedicated to holistic well-being. One of its most striking features is its scientific layout, where medicinal plants are arranged according to their therapeutic use and their association with the five elements of nature—Earth, Water, Fire, Air, and Space. This design helps visitors easily understand the relationship between natural elements and human health.

The garden houses hundreds of medicinal plant species, each clearly labelled with botanical name, local name, and medicinal value. Interpretative signboards and information panels make the space educational yet engaging, especially for students and first-time visitors. Well-maintained walking trails, seating areas, and shaded zones allow visitors to explore the garden at a relaxed pace, encouraging reflection and mindfulness.

Another notable feature of Arogya Van is its focus on preventive healthcare and awareness. The garden promotes the principles of Ayurveda, yoga, and natural living rather than curative medicine alone. The calm ambience, enhanced by native vegetation and water elements, creates an environment that supports mental relaxation alongside physical learning. Importantly, Arogya Van also serves as a green lung and conservation space, preserving valuable medicinal flora for future generations.

As I walked through these thoughtfully curated sections, I realized that Arogya Van is not designed merely for viewing plants. It is designed for experiencing wellness. Leaving Arogya Van, I carried a question: Can such a space be created closer to home? For a state like Assam, the answer feels not only possible, but promising.

Assam is blessed with extraordinary biodiversity and a rich heritage of herbal and folk medicine practiced by its indigenous communities. Situated within global biodiversity hotspots, the state naturally supports a wide range of medicinal plants. Establishing an Arogya Van in Assam would therefore be a natural extension of its ecological and cultural strengths, contributing to conservation, education, and public health.

An Assam-based Arogya Van could showcase region-specific medicinal plants such as Manimuni (Centella asiatica) and Brahmi (Bacopa monnieri) for cognitive health; Bhedailota (Paederia foetida) for digestive ailments; Bhringaraj (Eclipta prostrata) for liver and hair care; and important species like Kalmegh, Pipoli, Amla, Sarpgandha, and the culturally significant Kopou Phool (Rhynchostylis retusa). Displaying these plants in a structured, interpretative manner would help preserve both biodiversity and indigenous knowledge.

Beyond conservation, an Arogya Van in Assam could become a hub for community participation, research, and eco-wellness tourism. Involving traditional healers, local farmers, students, and institutions would ensure that the garden remains a living, evolving space rather than a static exhibit. Guided walks, awareness programs, and wellness activities could bring traditional knowledge closer to modern society.

In a time when fast-paced lifestyles and environmental stress affect both health and harmony, Arogya Van offers a gentle reminder that wellness lies in balance. Inspired by the thoughtful design and purpose of Gujarat's Arogya Van, Assam has the opportunity to create its own space of healing, rooted in tradition, enriched by biodiversity, and open to all.

Sometimes, a journey doesn't end where it began. My visit to Arogya Van felt like the beginning of a vision one that Assam is uniquely placed to bring to life.

Baratang Island-The Hidden Gem of Andaman & Nicobar

Gourismita Nath
Roll No: 7

Baratang Island is one of the principal islands in the Andaman and Nicobar archipelago, located in the Bay of Bengal, India. It is known for its diverse natural landscapes, limestone caves, mud volcanoes, mangrove creeks, and tropical forests, offering a blend of geological, ecological, and cultural significance. This island serves as both a geographical and cultural gateway between the South Andaman and Middle Andaman regions and is an increasingly popular eco-tourism destination. It is situated approximately 100 km North of Port Blair, the capital of the Andaman and Nicobar Islands. It spans an area of around 238 square kilometres and is part of the North and Middle Andaman district. Baratang offers a raw, untamed experience characterized by dense tropical forests, ancient tribal reserves, and geological wonders that have been millions of years in the making.

Baratang Island is connected to Port Blair by both road and ferry services. The Andaman Trunk Road (NH-4) connects Port Blair to Baratang, covering about 100 kilometres. The journey includes crossing the Middle Strait, where vehicles and passengers are ferried across by boats operated by the administration. Passenger ferries also operate from Port Blair to Baratang Jetty at regular intervals.

❖ **Typical road route:**

- Port Blair → Jirkatang Check Post (~35–40 km) — early departure (around 4–5 AM) is recommended to catch the morning convoy.

- Jirkatang → Middle Strait (through Jarawa Reserve) (~45–50 km) — passes through protected tribal reserve under strict rules.
- Vehicle ferry across Middle Strait (~10–15 min) — take a government vehicle ferry to Nilambur Jetty (Baratang)

❖ **Jarawa Tribe:** The journey to the island is an adventure in itself. To reach it, travelers must drive through the Jarawa Tribal Reserve, a protected forest area home to one of the world's oldest isolated tribes. The Jarawa are an indigenous, nomadic hunter-gatherer tribe of the Andaman Islands, recognized as a Particularly Vulnerable Tribal Group (PVTG) and known for their traditionally isolated lifestyle, deep forest knowledge, and distinct language. Since limited voluntary contact began in the mid-1990s, efforts have focused on cultural preservation while addressing threats from habitat loss and external influences.

❖

❖ **Mangrove Forests and Creeks:** Baratang is enveloped by dense mangrove ecosystems, especially along creeks such as Parrot Creek. These mangrove belts act as natural barriers against coastal erosion and provide vital breeding grounds for fish and crustaceans. The mangrove boat rides are among the most picturesque experiences on the island. The lush greenery supports diverse flora and fauna, making it a paradise for nature lovers and bird watchers.

❖ **Limestone Caves:** The limestone caves of Nayadera and Baludera are major

attractions on the island. These caves, formed over millennia by the accumulation and compaction of marine organisms, exhibit impressive stalactite and stalagmite formations.

- **Groundwater Action:** Rainwater dissolves limestone as it seeps through cracks, becoming calcium bicarbonate-rich.
- **Stalactite:** As this mineral-laden water drips from the cave ceiling, carbon dioxide escapes, and a tiny limestone deposit is left, growing downwards as a cone or icicle like form.
- **Stalagmite:** Drops falling from the stalactite onto the floor deposit more limestone, building up a mound that grows upwards, often thicker and flatter than stalactites.
- **Pillar/Column:** When a stalactite and the stalagmite directly below it grow long enough to join, they form a complete vertical pillar or column.

- **Mud Volcanoes:** Baratang Island is famous for its mud volcanoes, which are among the few such formations in India. These natural features occur when gases and liquids from underground erupt through the surface, releasing mud and gases instead of lava. The most accessible mud volcano is located near Nilambur Village, about 7 kilometres from Baratang Jetty.
- **Edible-nest Swiftlet:** Baratang Islandn is known for its rich swiftlet populations, especially the Edible-nest Swiftlet (*Aerodramus fuciphagus*), whose saliva-built nests are prized for bird's nest soup. The island is also home to the White-bellied Swiftlet, and both species rely on Baratang's extensive cave systems for nesting. However, swiftlet populations in unprotected caves are declining, highlighting the need for stronger conservation measures to protect these specialized aerial insectivores.

The conservation of Baratang Island should focus on protecting its caves, mangroves, and forests through stricter regulation and monitoring.

Sustainable tourism practices and controlled access to sensitive areas are essential to reduce ecological disturbance. Involving local communities and promoting awareness can further support long-term conservation efforts.

Barasingha Conservation in Kanha National Park: A Landmark Achievement in Wildlife Conservation

Daisy Baishya
Roll No: 05

On 13th July, 2025, as part of our Central West Tour, we visited Kanha National Park, one of India's most celebrated wildlife reserves and a global symbol of successful conservation. Among the many ecological stories associated with Kanha, the most inspiring is the revival of the Hard-ground Barasingha (*Rucervus duvaucelii branderi*), the state animal of Madhya Pradesh. Our visit provided deep insight into how scientific planning, habitat management, and sustained efforts helped save this unique species from the brink of extinction.

The Hard-ground Barasingha is a subspecies of swamp deer and is endemic to Kanha National Park, meaning it is found nowhere else in the world. Historically, this elegant deer thrived in the extensive grasslands of central India. However, by the early 1960s, its population witnessed a catastrophic decline, falling to a mere 60 individuals. This alarming reduction was caused by multiple factors, including extensive habitat loss due to land-use changes, the spread of diseases from domestic livestock, increased predation on fawns, and intense competition with grazing cattle. The situation became so critical that the Barasingha was on the verge of extinction, prompting urgent conservation action.

Recognizing the seriousness of the crisis, forest officials, wildlife biologists, and conservationists launched a scientific conservation and breeding program in Kanha National Park. One of the most innovative steps taken under this program was the construction of bomas. A boma is a large, fenced enclosure designed to provide a safe and controlled environment for wildlife. In Kanha, bomas were carefully constructed in selected grassland areas so that they closely resembled the Barasingha's natural habitat. These enclosures were equipped with natural grasses for grazing, water sources for drinking, and shaded areas for protection from heat, ensuring minimal stress to the animals. The primary objective of building bomas was to facilitate captive breeding under natural conditions. Breeding groups of Barasingha were placed inside

these enclosures, where they could be closely monitored by forest staff and veterinarians. This system made it possible to track breeding patterns, monitor the health of individuals, and provide timely medical care when needed. Importantly, the bomas also played a crucial role in protecting newborn fawns, which are extremely vulnerable during the first few weeks of life.

A major threat identified during the early years of the conservation program was predation by Indian Rock Pythons. These large snakes were found to be significant predators of Barasingha fawns, contributing heavily to infant mortality. To counter this challenge, python-proof fencing was introduced around the bomas. This fencing consisted of fine-mesh wire that was buried deep below ground level to prevent snakes from burrowing inside. Special care was taken to ensure that there were no gaps at the base of the fence, effectively blocking the entry of pythons, wild dogs, and other small predators.

The introduction of python-proof fencing proved to be a game-changer. It drastically reduced fawn mortality and significantly improved calf survival rates. With a safer environment ensured, the Barasingha were able to breed successfully, leading to steady population growth. The fencing, combined with regular monitoring and veterinary support, created a secure space where the species could recover without constant threats.

Beyond protecting the Barasingha, the conservation program emphasized scientific wildlife management. Controlled breeding helped maintain genetic diversity and prevented inbreeding, which is a common risk in small populations. Habitat restoration, especially the improvement of grasslands, was another critical component. These restored grasslands not only supported the Barasingha but also benefited other herbivores such as chital, sambar, and blackbuck, thereby strengthening the entire ecosystem of Kanha National Park.

The results of these sustained conservation efforts have been extraordinary. From a critically low population of about 60 individuals in the 1970s, the Barasingha population has now increased to over 800 animals. This remarkable recovery led to an improvement in the species' conservation status

from critically endangered to endangered. Today, Barasingha are no longer confined to bomas alone; they breed naturally and roam freely in the open grasslands of Kanha, a clear indicator of long-term ecological success.

Kanha National Park has now gained international recognition as a model for species recovery and conservation planning. The Barasingha conservation program is frequently cited as an example of how targeted interventions, backed by scientific research and committed management, can reverse the decline of even the most threatened species. The success of this program has inspired similar conservation initiatives across India and beyond.

In conclusion, our visit to Kanha National Park during the Central West Tour was both educational and deeply inspiring. The story of the Barasingha is not just about saving a single species; it represents the power of thoughtful conservation, community awareness, and scientific management in restoring ecological balance. Through the construction of bomas, the use of python-proof fencing, and continuous monitoring, Kanha has transformed a near-extinction crisis into one of India's greatest wildlife conservation success stories. The revival of the Barasingha stands as a lasting testament to what dedicated conservation efforts can achieve for the future of biodiversity.

Fig. Bomas constructed for Barasingha

Fig. Python Proof Fence

Borra Caves, Visakhapatnam: A Personal Narrative from a Geologist and a Forest Range Officer Trainee

Sabina Yasmin
Roll No: 30

My visit to Borra Caves, situated in the Ananthagiri hills of Visakhapatnam district in Andhra Pradesh, was not merely a journey to a tourist destination but a deeply personal and professional experience. Standing at the intersection of two disciplines—Geology and Forest Management—I found Borra Caves to be a place where my academic training and field responsibilities naturally converged. As a postgraduate in Applied Geology and presently serving as a Forest Range Officer trainee, I perceived the caves not only as a spectacular natural wonder but also as a fragile geo-ecological system demanding careful protection.

Personal Experience

As I descended into Borra Caves, the sudden drop in temperature and the stillness of the subterranean environment immediately struck me. Walking through the dimly lit chambers felt like stepping into geological time. Each stalactite and stalagmite silently narrated a story millions of years old. My training as a geologist allowed me to visualize the slow chemical processes behind these formations, while my role as a Forest Range Officer trainee made me aware of their vulnerability to human interference.

Geological Formation

Borra Caves are developed in Precambrian limestone and dolomitic limestone formations of the Eastern Ghats Mobile Belt. The caves were formed through karst processes, where mildly acidic groundwater dissolved calcium carbonate along fractures and joints. Speleothems such as stalactites,

stalagmites, and columns indicate prolonged and uninterrupted geological activity.

Forest and Ecological Significance

The caves are surrounded by dense forests of the Eastern Ghats, which play a crucial role in maintaining groundwater recharge and microclimatic stability. The cave ecosystem supports bats and other specialized fauna, making it ecologically sensitive. Any disturbance to the surrounding forests directly impacts the cave system.

Artificial Lighting: Positive and Negative Aspects

In my considered opinion, Borra Caves should be allowed to remain as close to them natural state as possible. Excessive artificial lighting makes the cave appear staged and artificial, reducing its geological authenticity. Positive aspects of artificial lighting include improved visitor safety, accessibility, and educational visibility of formations. However, continuous lighting alters the cave's microclimate, promotes lampen flora growth, and disturbs cave-dwelling fauna, particularly bats. Therefore, lighting should be minimal, scientifically designed, and conservation-oriented.

Conclusion

Borra Caves represent a priceless geo-heritage site where geology, ecology, and forest management intersect. My visit reinforced my professional responsibility to conserve such fragile natural systems. Protecting Borra Caves means preserving not only a tourist destination but a living record of Earth's deep history.

Butterfly Parks as Conservation Landscapes

Oli Borah
Roll No. 24

Butterflies are among the most admired insects because of their colours, graceful flight, and close association with nature. Apart from their aesthetic appeal, butterflies play an important ecological role as pollinators and act as sensitive indicators of environmental change. Increasing human activities, especially in urban and semi-urban landscapes, have led to the loss and fragmentation of natural butterfly habitats. In this context, butterfly parks and conservatories play an important role in conserving butterflies while also creating awareness among people.

During our South India and North India study tours as Forest Range Officer trainees, we visited three butterfly conservation sites: the Tropical Butterfly Conservatory at Tiruchirapalli, the Butterfly Park at Bannerghatta, and the Butterfly Park at Chandigarh. Each of these sites follows different management approaches but is based on the same ecological principles of habitat creation and butterfly gardening.

Tropical Butterfly Conservatory, Tiruchirapalli

The Tropical Butterfly Conservatory at Tiruchirapalli is designed to closely replicate natural butterfly habitats. It is uniquely located between two rivers, which helps maintain favourable humidity and a suitable micro-climate for butterflies throughout the year. The landscape planning focuses on creating an enabling environment rather than a formal garden layout.

A wide variety of host plants and nectar plants, relevant to locally occurring butterfly species, have been planted. Adult butterflies depend mainly on nectar plants for food, while female butterflies search for specific larval host plants to lay eggs and support caterpillar growth. Most of the larval host plants maintained here are native and medicinal plants, reflecting their ecological importance.

In addition, roosting plants are provided for resting, along with ornamental plants that enhance aesthetic value without disturbing butterfly ecology. The

habitat also includes open sunny areas, shaded patches, rocks, and mud-puddling zones. These features provide essential salts and amino acids required for butterfly growth and reproduction. Regular monitoring, plant maintenance, and awareness activities form an important part of management.

Fig. Tropical Butterfly Conservatory, Tiruchirapalli

Fig. Caterpillar on host plant, Tropical Butterfly Conservatory

Butterfly Park, Bannerghatta

The Butterfly Park at Bannerghatta Biological Park in Bengaluru represents a well-planned conservation and education model within a forest landscape. The park consists of both an open garden system and a closed garden or conservatory system. The open garden allows butterflies to move freely and interact with the surrounding forest ecosystem, while the closed garden provides controlled conditions of temperature, humidity, and light. This combination supports butterfly species with different habitat requirements.

An important feature of this park is the butterfly breeding centre, where butterflies are bred under controlled conditions and their complete life cycle is demonstrated. This clearly highlights that butterflies are host-plant specific, and successful breeding depends on the correct identification and availability of suitable host plants. Habitat enrichment, plantation of nectar and host plants, maintenance of sunny and shaded patches, and visitor education are key management activities at this park.

Fig. Butterfly Park, Bannerghatta

Fig. Butterfly feeding setup at Butterfly Park (Bannerghatta)

Butterfly Park, Chandigarh

The Butterfly Park at Chandigarh is an excellent example of butterfly conservation within an urban landscape, developed by the Forest & Wildlife Department, Chandigarh Administration. The park has been landscaped to function as a butterfly habitat rather than a manicured garden.

A wide range of host plants such as Ashoka, Salix, Mango, Citrus, Amla, Palm, Ricinus, Ixora, Calotropis, Bael, and Capparis have been planted to support different stages of the butterfly life cycle. For adult butterflies, several nectar plants including Marigold, Petunia, Lantana, Gazania, Salvia, Impatiens, Ageratum, and Dahlia are grown. Rows of nectar plants like Lantana, Black Sesame, and Hamelia ensure continuous food availability.

Natural features such as undisturbed patches, fallen leaves, and moist areas are deliberately retained. These provide shelter, maintain moisture, and support mud-puddling, which supplies essential salts and sodium to butterflies. A butterfly conservatory within the park is designed to enhance butterfly visibility for visitors and includes host plants, nectar plants, a circulating water feature, damp patches, visitor pathways, and interpretive signage explaining butterfly habitat, life cycle, and plant associations.

Fig. Butterfly habitat at Butterfly Park, Chandigarh

Fig. Butterfly Park, Chandigarh

Butterfly Gardening

Butterfly gardening is a simple yet effective approach to attract, retain, and conserve butterfly populations. The best butterfly gardens consist of a rich diversity of nectar plants and host plants, selected according to butterfly species found locally. Butterflies have different food requirements at different stages of their life cycle. Adult butterflies depend mainly on nectar plants, while female butterflies actively search for specific host plants on which to lay eggs and support caterpillar growth. Most larval host plants are native and medicinal in nature, highlighting their ecological value.

Apart from plants, butterflies also require open sunlight, shaded resting places, rocks, and moist mud-puddling areas. These mud-puddling zones provide salts and amino acids essential for butterfly health. Flowers attract the greatest number of butterflies and also play a key role in pollination, benefiting both plants and insects. In the face of increasing habitat loss, especially in urban areas, butterfly gardening offers an easy and effective way to conserve butterflies while also acting as a stress reliever and enhancing the aesthetic and ecological value of landscapes.

Importance and Management Implications

Butterflies have ecological, scientific, educational, aesthetic, health, and economic value. They play a key role in pollination, help maintain plant diversity, and act as early indicators of environmental change. Butterfly parks

demonstrate that conservation is closely linked to habitat quality and plant diversity.

For forest managers, these models provide valuable lessons. Butterfly parks can be developed in forest areas, eco-tourism zones, educational institutions, and urban spaces. With proper planning and minimal disturbance, even small landscapes can support healthy butterfly populations while promoting environmental education and public awareness.

Conolly's Plot: A living monument to the world's Oldest Teak Plantation

Moitree Gogoi
Roll No-17

Conolly's Teak Plantation, located in the Nilambur region of Kerala, is recognized as the oldest teak plantation in the world, established in 1844 by H. V. Conolly, the then Collector of Malabar. The plantation represents a landmark in the history of scientific forest management and sustainable timber production. The largest tree in conolly's Plot is a majestic teak tree identified as tree number 23 (also known as the "Ambassador Teak".

The plantation was initiated in response to excessive exploitation of natural teak forests for shipbuilding and construction. Conolly's systematic approach to plantation forestry proved successful and became a model for teak cultivation across tropical regions.Situated along the banks of the Chaliyar River, the plantation benefits from fertile alluvial soil, high rainfall, and favourable climatic conditions. These factors contribute to excellent teak growth and long-term sustainability.

The plantation demonstrates classical silvicultural techniques such as line planting, regulated spacing, thinning, and removal of inferior trees. These practices enhanced timber quality and ensured optimal growth over long rotations. The large girth and height of the teak trees reflect effective management over nearly two centuries. The site continues to provide valuable data on growth patterns and yield under managed plantation conditions.

In addition to timber value, the plantation supports biodiversity and serves as an outdoor classroom for forestry students, researchers, and professionals. It highlights the balance between production forestry and ecological stability. Managed by the Kerala Forest Department, the plantation is protected through controlled access, health monitoring, and conservation-focused management. Emphasis is placed on preserving its historical and ecological integrity.

To ensure the continued relevance and sustainability of Conolly's Teak Plantation, the following measures could be taken into account:

- **Strengthening Conservation Efforts**: Enhance protection against pests, diseases, climate stress, and human disturbances through regular monitoring and scientific interventions.
- **Research and Documentation**: Promote long-term research on climate resilience, carbon sequestration, and genetic diversity of teak using this historic plantation as a reference site.
- **Educational Outreach**: Develop structured educational programs, guided tours, and interpretation centers to raise awareness among students, policymakers, and the public.
- **Replication of Best Practices:** Apply lessons learned from Conolly's plantation to modern teak plantations, emphasizing sustainable rotations, mixed planting, and ecosystem-based management.

Conolly's Oldest Teak Plantation stands as a testament to visionary forest management and scientific planning. With appropriate conservation, research, and educational initiatives, this historic plantation can continue to guide sustainable forestry practices and inspire future generations.

Dal Lake — Jewel of Srinagar

Kulumanali Gogoi
Roll No-14

Dal Lake, cradled in the heart of Srinagar, is more than a scenic postcard, it is a living wetland that supports local livelihoods, unique culture (houseboats, shikaras and floating gardens), migratory birds and a fragile freshwater ecosystem. Its shallow waters and reed-fringed shores mirror the Pir Panjal mountains and the seasons of Kashmir, making Dal a symbol of the region's natural and cultural identity. Managing and protecting this treasure is therefore both an environmental and a socio-economic imperative. Dal lake is situated in the state of Jammu and Kashmir (J&K), the northern-most state of India, strategically surrounded by four countries, on the East by Tibet, on the North-East by China, on the North by Afghanistan and on the West by Pakistan. Dal Lake is a Himalayan Urban Lake, located in the heart of Srinagar (Latitude 3418'N Longitude 7491'E) at an average altitude of 1,583 M. Srinagar is the summer capital of J&K. The top crust of the Lake has also been observed to freeze during winters when the temperature falls to -11 ℃. Early spring and summers are the wet periods when maximum rainfall occurs and average annual rainfall recorded is 655 mm. It is in this season that the snow thaw in the higher catchment results in maximum discharge in Dachigam & Dara Nallah which inflows into the Lake.

Dal Lake has been an epitome of the Kashmiri Civilization from times immemorial. Kalhana a 12th Century poet writes in his Rajtarangini "It is a place where the sun shines mildly, being the place created by Kashayapa as if for his glory. The saffron, iced-water and grapes, which are rare even in heaven, are common here. Kailasa is the best place in the three worlds, Himalaya the best part of Kailasa, and Kashmir the best place in Himalaya". Hassan (1833) in his celebrated history of Kashmir popularly known as Tarikh-i-Hassan gives a detailed account of origin and evolution of Dal Lake based on ancient historian Pt. Ratnakar (Ratnakarpuran) written 300 years earlier than Kalhan's Rajtarangini. According to Hassan in olden times at the site of present Dal Lake was a plain desert which was known as Vitalini Marg. King Pravarsen closed the river Behat (now Jhelum) from Nowpora side and brought the river into city by way of the foot of Kohimaran. Walter R. Lawrence,

who was Resettlement Commissioner of Kashmir, in 1887, writes “Perhaps in the whole world there is no corner as pleasant as the Dal Lake. The water of the Dal is clear and soft as silk, and the people say that the shawls of Kashmir owe much of their excellence to being washed in the soft waters of the lake”. The importance of the lake as a tourist resort is more than five centuries old. Several rulers in the past used the lake for recreation and its beautified surroundings. The famous Moghul gardens around the lake have been built during 16th –17th century. In 18th and 19th century the city of Srinagar started expanding towards the lake resulting in far reaching changes in the lake environs. Human interference by way of settlement in the lake to facilitate pedestrian traffic and establishment of lake tourism by providing floating residences (house-boats) got accelerated. As we embark our journey to Char chinar island through boat, we could see the pristine beauty of the lake surrounded by Mughal gardens and blue mountains. The Char chinar is an island located on the Lakut Dal lake & is marked with four Chinar trees growing at the corners thus known as Char chinari.

Ecologically, Dal Lake provides habitat for fish and birds, filters run-off from its catchment, and stores water that moderates local microclimate. Culturally and economically, thousands depend on the lake for tourism, houseboat and shikara incomes, fisheries and seasonal vegetable gardens grown on floating mats of vegetation (locally called *rad*). The lake’s wellbeing therefore directly affects biodiversity, tourism revenue and everyday life in Srinagar.

Cultural and Social Significance

Dal Lake occupies a central place in Kashmiri culture. Traditional houseboats, locally crafted wooden marvels, are symbols of Kashmiri hospitality and artistry. Shikaras, the elegant wooden boats, are not merely tourist attractions but everyday transport for lake dwellers—used to travel to markets, schools and neighbours’ homes. The lake has inspired Kashmiri poetry, folk songs, paintings and literature, often symbolising beauty, romance and serenity. Festivals, family gatherings and social interactions frequently revolve around the lake, making it a shared cultural space rather than just a natural feature.

Economic Importance and Livelihoods

Dal Lake is a source of livelihood for the local people. Tourism plays a significant role in livelihood generation. Houseboat owners, shikara operators, guides, artisans, hotel workers and vendors depend heavily on the lake-driven tourism economy. Traditional fishing supports many families, providing both food security and income. Floating vegetable gardens (Rad) are unique to Dal Lake, these floating gardens produce vegetables such as cucumbers, tomatoes and gourds, supplying local markets and sustaining lake-based agriculture. Thus, the lake functions as a natural economic engine for Srinagar.

Ecological and Environmental Role

Dal Lake plays a crucial ecological role in the life of Kashmiris. It helps regulate the local climate, cooling summers and supporting humidity balance. Also acts as a natural water reservoir, aiding groundwater recharge. It supports biodiversity, including fish species, aquatic plants and migratory birds, which are integral to the valley's ecological health. A healthy Dal Lake directly contributes to clean air, water security and environmental stability for surrounding communities.

Educational and Traditional Knowledge Value

Dal Lake serves as a living classroom. Traditional knowledge of boat-making, fishing techniques, aquatic farming and wetland management has been passed down through generations. This indigenous wisdom reflects sustainable coexistence with nature and forms an important part of Kashmiri heritage. The lake is also associated with spiritual calm, with mosques, gardens and shrines around its periphery enhancing its sacred and reflective character.

Fig. Boating at Dal Lake

Challenges faced by the Forest Department and other line agencies

Protecting Dal Lake is a challenging work and the forest department (often responsible for shoreline vegetation, reedbeds and some enforcement) faces persistent hurdles such as pollution, invasive weed growth, siltation, grazing & encroachment etc. Dal Lake is managed by Lake Conservation & Management Authority (LCMA/LDMA). Major challenges faced by LCMA are:

- **High nutrient and pollution load.** A legacy of untreated or partially treated domestic sewage and agricultural runoff continues to deliver nitrogen and phosphorus to the lake, accelerating eutrophication and weed growth. Even with Sewage Treatment Plants (STPs), maintenance and complete interception remain problematic.
- **Invasive weeds and rapid regrowth.** Mechanical removal is labor-intensive and expensive; weeds like water hyacinth and invasive lilies reappear quickly if nutrient inputs are not lowered. This makes weed control a recurring cost and operational headache.
- **Siltation and catchment degradation.** The lake receives heavy silt loads from a largely denuded catchment; weakened upland land cover and unplanned construction escalate sediment inflow that reduces water depth and chokes channels—complicating fisheries, navigation and aquatic habitat management. Addressing this requires landscape-scale watershed measures beyond the forest department's immediate remit.
- **Encroachment and unregulated development.** Illegal reclamation, shoreline encroachment and expansion of settlements and commercial activity along the foreshore reduce buffer areas and complicate enforcement. The forest department must often coordinate with municipal and land revenue bodies to resolve land tenure and eviction issues—processes that are legally and politically fraught.
- **Coordination and resource constraints.** Effective lake management requires integrated action across multiple departments (LCMA, forest, municipal, fisheries, irrigation, tourism). Limited budgets, equipment shortages, and overlapping jurisdictions slow rapid action and monitoring. The forest department also faces manpower shortages for sustained patrolling, weed management and community engagement.

Conservation efforts by the Lake Conservation & Management Authority (LCMA / LDMA)

Since its formation, the Lake Conservation & Management Authority (LCMA, now referred to as LDMA) has acted as the central authority for planning and implementing restoration and management of Dal Lake catchment area and nearby Nigeen Lake. Key interventions by the Authority and partner agencies include:

- **Weed-management and biomass utilisation.** Large quantities of invasive water weeds and lilies are mechanically removed from the lake. Authorities have piloted converting this extracted biomass into organic compost/manure to both reduce waste and provide a sustainable output from cleanup activities.
- **Mechanical dredging and de-siltation.** Dredging at selected locations addresses siltation that shallows the lake and alters hydrology. Dredged material is being managed for reuse where feasible.
- **Sewage interception and treatment.** To curb nutrient loading (which fuels algal blooms and weed growth), the LCMA and municipal agencies have worked to install and upgrade sewerage treatment plants and intercept sewage outfalls around the lake's periphery.
- **Aerators and fountains.** Aeration devices and decorative fountains have been deployed to improve dissolved oxygen levels and support lake aesthetics—both conservation and tourism objectives.
- **Infrastructure and governance measures.** The Authority uses GIS and survey maps, enforces buffer zones, regulates houseboat operations and coordinates with stakeholders (local communities, tourism bodies, fisheries, and forest and municipal departments) through MoUs and project agreements. These measures have reduced some visible symptoms (weed mats, blocked channels, ugly pollution) in places, and have strengthened institutional capacity for continued intervention.
    - **Catchment restoration.** Large-scale afforestation, soil conservation and check-dams in feeder streams will reduce siltation. This needs central funding and cross-departmental planning.
    - **Community empowerment.** Engage houseboat owners, fisherfolk and local residents with co-management arrangements — payment for

ecosystem services, training in eco-tourism best practices, and inclusion in monitoring.

Fig. Plantation done by LCMA in the Dal lake catchment area

Dal Lake is not just a water body in Srinagar; it is the lifeline, identity and soul of Kashmir. For centuries, the lake has shaped the social, cultural, economic and emotional life of Kashmiri people. Often called the *"Jewel of Srinagar"*, Dal Lake is deeply woven into daily living, traditions and collective memory of the valley. Its waters reflect not just mountains and skies, but the history, struggles and aspirations of Kashmir. Preserving Dal Lake is essential for sustaining the way of life of Kashmiris and safeguarding the heritage of the valley for future generations. The LCMA's interventions have shown what coordinated action can achieve, yet long-term success depends on stopping pollution at its source, restoring the catchment, and sustaining community-centred stewardship.

Fig. Visit to Char chinar Dal Lake

Electronic Eye Technology at Kaziranga National Park and Jim Corbett National Park

Kulumanali Gogoi
Roll No: 14

India's protected areas face constant challenges from poaching, illegal intrusion, human–wildlife conflict, and the sheer difficulty of monitoring vast and often inaccessible landscapes. To strengthen wildlife protection, modern technology has been introduced alongside traditional forest patrolling. One such innovation is Electronic Eye (e-Eye) technology, an advanced surveillance system adopted in major tiger reserves and national parks developed under India's National Tiger Conservation Authority (NTCA). It combines advanced sensors and cameras to continuously watch sensitive zones in wildlife reserves. During our East India & North India study tour, we were able to see two prominent examples where e-Eye technology plays a crucial role in conservation and protection: Kaziranga National Park in Assam and Jim Corbett National Park in Uttarakhand.

Electronic Eye technology (e-Eye) is a smart surveillance and monitoring system that uses a combination of thermal imaging cameras, infrared sensors, motion detectors and digital communication networks. These devices are installed at strategic locations such as park boundaries, vulnerable corridors, river crossings, and poaching-prone areas. The system continuously monitors movement and sends real-time alerts to a centralized control room when unusual activity—such as human intrusion, vehicle movement, or animal presence—is detected. This enables forest staff to respond quickly and effectively.

Electronic Eye Technology at Jim Corbett National Park

Jim Corbett National Park, India's oldest national park and one of the country's most important tiger reserves, was among the first protected areas

to pilot e-Eye technology, launched by NTCA in 2010 to provide 24/7 watch, track animal movement and alert control room about human intrusion.

Key Features and Applications

High-resolution thermal and infrared cameras mounted on towers can detect movement both day and night. The system is capable of sensing the movement of large animals or humans, even in dense forest cover and low-visibility conditions (Motion detection and alert systems).

Alerts are instantly transmitted to park control rooms & NTCA office and field staff, allowing rapid deployment of anti-poaching squads. e-Eye technology helps monitor sensitive border areas, forest fringes, and routes commonly used by poachers.

Impact at Corbett

The introduction of electronic surveillance has significantly strengthened anti-poaching efforts. It acts as a deterrent to illegal activities, reduces dependence solely on foot patrols, and improves the safety of frontline forest staff. Combined with regular patrolling and intelligence networks, e-Eye has contributed to better protection of tigers and their habitat.

Electronic Eye Technology at Kaziranga National Park

Kaziranga National Park, a UNESCO World Heritage Site, is globally renowned for hosting the largest population of the one-horned rhinoceros, along with tigers, elephants, and swamp deer. Due to persistent threats from poaching and heavy pressure from surrounding human activities, advanced surveillance is essential. E-eye corner was established here in 2015 with 6 crore projects from NTCA.

Key Features and Applications

High-resolution thermal and infrared, Motion-based cameras are used to track animal movement and detect unauthorized human entry. e-Eye systems support anti-poaching operations, particularly for rhinos, which have

historically been targeted. Eight (8) towers with high resolution infrared cameras have been installed at specific locations near Brahmaputra River, northern border of the park (Height: 45 m & 5 km radius of each tower). 24/7 hours operated solar powered towers based on Image Processing Algorithm. The technology assists in monitoring wildlife movement near highways and corridors, helping reduce animal–vehicle collisions. Live feeds and alerts with GPS locations to control rooms, enabling coordinated and timely action by forest staff.

In Kaziranga, electronic surveillance complements other modern tools such as camera traps, drones, and GPS-based patrolling systems. Together, these technologies enhance situational awareness, improve response time, and strengthen overall protection of wildlife and habitat.

Conclusion

The adoption of Electronic Eye technology at Jim Corbett National Park and Kaziranga National Park represents a significant step toward technology-enabled wildlife conservation in India. By providing real-time surveillance, improving response capability, and strengthening anti-poaching measures, e-Eye systems have enhanced the protection of iconic species such as tigers and one-horned rhinoceroses. While not a substitute for human effort, electronic surveillance has become an indispensable tool in safeguarding India's rich natural heritage for future generations.

Elevated Corridor Program in Protected Areas Lessons from Pench Tiger Reserve to Kaziranga National Park

Kulumanali Gogoi
Roll No: 14

Rapid expansion of roads, highways and railways across India has significantly improved connectivity and economic growth. However, when such linear infrastructure passes through forests and protected areas, it often fragments habitats, disrupts wildlife movement and increases wildlife mortality due to vehicle collisions. To address this challenge, the Elevated Corridor Program has emerged as an innovative and ecologically sensitive solution.

An elevated corridor is a raised road or flyover constructed above the natural ground level, allowing wildlife to move freely underneath without obstruction. The Elevated Corridor Program aims to balance infrastructure development with wildlife conservation. Instead of widening roads at ground level—which increases barriers to animal movement—the road is elevated on pillars, creating an uninterrupted passage for animals below. India's first large-scale and widely discussed example of this approach is the elevated corridor through Pench Tiger Reserve. Building on its success, a similar project is now proposed for Kaziranga National Park, one of the world's most important biodiversity hotspots.

Key features of an elevated corridor include: Minimal disturbance to natural terrain; free and safe movement of animals beneath the structure; reduced wildlife–vehicle collisions and maintenance of ecological connectivity between habitats This approach is especially useful in protected areas, wildlife corridors, and migration routes where animal movement is frequent and essential for survival.

Pench Tiger Reserve: A Pioneering Example

During our West-Central India Tour, we visited Pench Tiger Reserve, located in Madhya Pradesh and Maharashtra, which is an important tiger landscape with rich biodiversity. National Highway-44 (earlier NH-7), which connects Nagpur and Jabalpur, passes through the reserve. Before intervention, this stretch witnessed frequent road kills of animals such as tigers, leopards, deer, wild dogs, and reptiles. To mitigate these impacts, a 16 km long elevated road corridor was constructed through the core area of Pench Tiger Reserve. The road was raised on pillars, with limited access points and strict speed regulation.

Important design elements included: Adequate height to allow free movement of large mammals; natural ground retained beneath the corridor; use of noise-reducing and animal-friendly construction techniques and continuous monitoring using camera traps and field surveys.

Ecological Outcomes: The Pench elevated corridor is considered as a landmark in conservation-friendly infrastructure. Post-construction studies and monitoring have shown significant reduction in wildlife mortality due to road accidents**;** regular use of the underpass area by tigers, leopards, herbivores, and smaller fauna**;** restoration of habitat connectivity between forest patches & improved coexistence between development and conservation goals. Pench thus serves as a model for sustainable infrastructure planning in ecologically sensitive areas. Other than Pench, we have also visited Rajaji National Park (Uttarakhand), Bandipur Tiger Reserve (Karnataka) & Kawal Tiger Reserve corridor (Telangana) where we have seen successful implementation of the elevated corridor program.

Need for Elevated Corridors in Kaziranga National Park

Kaziranga National Park, a UNESCO World Heritage Site in Assam, is globally famous for the world's largest population of one-horned rhinoceros & also for world's third highest density of royal Bengal tigers along with significant populations of elephants, wild buffalo, swamp deer, and diverse bird species.

The park lies in the floodplains of the Brahmaputra River and depends heavily on seasonal animal movement, especially during annual floods when animals migrate to higher ground (Karbi Anglong hills). We visited Kaziranga National Park & Tiger Reserve during our East India study tour and informed that the National Highway-37 (now NH-715) runs along the southern boundary of Kaziranga and has long been identified as a major threat due to high incidence of wildlife road kills, particularly during floods. Despite measures such as speed limits, animal crossings, and night traffic regulation, mortality risks remain high.

The proposed elevated corridor in Kaziranga aims to ensure safe passage & natural flood-driven migration routes for wildlife, especially rhinos, elephants, and deer. It's a major infrastructure project on NH-715, featuring a 34 km elevated viaduct between Kaziranga & Karbi Anglong hills, preventing fatal accidents during floods & improving regional connectivity, part of four Lanning highway project approved by government. It includes elevated sections as well as & tunnels for animal movement acting as underpasses & overpasses. The program will not only benefit the wildlife but will also reduce human-wildlife conflict and will enhance eco-sensitive development and green infrastructure.

Conclusion

The Elevated Corridor Program represents a forward-looking approach to resolving the long-standing conflict between infrastructure development and wildlife conservation. These projects aim to reduce wildlife mortality on roads

and maintain genetic connectivity between fragmented habitats, showing India's commitment to balancing infrastructure with biodiversity & conservation. The successful implementation of the elevated corridor in Pench Tiger Reserve has demonstrated that roads need not be barriers to nature. As the project moves forward in Kaziranga National Park, it carries immense potential to safeguard one of India's most treasured ecosystems while setting new standards for conservation-sensitive development. If carefully planned and executed, the Kaziranga elevated corridor can become a national and international benchmark, reinforcing the principle that development and conservation can progress together.

Fish-bone Canal System in Bhitarkanika National Park

Oli Borah
Roll No. 24

Mangrove ecosystems mainly depend on tidal water movement, and their survival requires the regular flow of saline and brackish water through natural creek systems. During our East India Tour, we visited Bhitarkanika National Park in Odisha, one of India's largest and most ecologically important mangrove areas, where conservation efforts focus not only on protection and regeneration but also on restoring natural water flow. The Fish-Bone Canal System is an eco-friendly management approach developed to restore tidal water movement in mangrove areas where it had been disturbed.

Concept and Design of the Fish-Bone Canal System

The Fish-Bone Canal System is based on the idea of copying natural tidal creek patterns found in mangrove forests. The system gets its name from its shape, which looks like the skeleton of a fish. A centrally aligned main canal works as the main channel for tidal water, while several smaller branch canals extend on both sides at regular intervals. These branch canals help distribute tidal water into the inner parts of the mangrove forest.

The canals are excavated below the natural ground level. This allows tidal water to enter the mangrove area during high tide and flow out naturally during low tide. The design closely follows natural tidal processes and ensures proper flooding and drainage. By restoring regular tidal movement, the system prevents long-term water stagnation and creates favourable conditions for mangrove survival and regeneration.

Ecological Functioning and Mangrove Response

By restoring tidal connectivity, the Fish-Bone Canal System helps regulate soil salinity, moisture, and aeration in mangrove areas. Regular tidal flushing

prevents excess salt from building up in the soil and removes harmful substances. Periodic drainage improves oxygen availability for plant roots. These conditions are essential for the healthy growth and natural regeneration of mangrove species such as *Avicennia*, *Rhizophora*, *Sonneratia*, and *Bruguiera*.

The canal network also allows fish, prawns, crabs, and other aquatic organisms to move into the inner mangrove zones. This improves nutrient movement and strengthens the link between aquatic and land-based parts of the ecosystem. Healthier mangroves also become more resilient to natural stresses such as cyclones, storm surges, and changes in sea level.

Management Significance and Practical Implications

The experience of Bhitarkanika National Park clearly shows that restoring natural water flow is essential for effective mangrove management. Plantation and regeneration efforts can succeed in the long term only when supported by proper tidal conditions. The Fish-Bone Canal System highlights the importance of addressing water-related problems instead of relying only on plantation activities.

The system also shows the benefit of working with natural processes rather than using rigid engineering structures. By using gravity-driven tidal flow and imitating natural creek patterns, the system provides long-term ecological benefits with very little maintenance. This low-impact approach is especially suitable for protected areas, where ecological sensitivity is very important.

Another important lesson from this system is the need for site-specific planning and flexible management. The alignment, depth, and spacing of canals must be designed according to local land conditions, sediment movement, and tidal range. Regular field monitoring is necessary to prevent siltation and to maintain smooth water flow. This highlights the role of forest officers as adaptive managers who respond to changing field conditions.

The Fish-Bone Canal System also shows that mangrove conservation is closely linked with overall biodiversity conservation. Improved tidal flow enhances habitat quality not only for mangrove plants but also for many

animal species. In Bhitarkanika, this directly supports the conservation of estuarine fish, invertebrates, birds, and important species such as the saltwater crocodile.

Broader Conservation Relevance

The success of the Fish-Bone Canal System in Bhitarkanika National Park provides useful lessons for mangrove restoration in other coastal and delta regions of India. It highlights the need to integrate hydrology, vegetation dynamics, and biodiversity into a single management approach. The system stands as a practical example of ecosystem-based management, showing that long-term conservation success comes from restoring natural processes rather than increasing human control.

The Fish-Bone Canal System in Bhitarkanika National Park represents a scientifically sound and ecologically effective approach to mangrove conservation. By restoring tidal connectivity and maintaining the natural rhythm of water movement, the system supports mangrove regeneration, improves biodiversity, and strengthens ecosystem resilience. For forest managers and trainees, Bhitarkanika serves as a living classroom, reinforcing a key principle of mangrove management: healthy mangrove forests depend not only on trees, but also on the continuous and natural flow of tidal water that shapes their survival.

From Conflict to Coexistence: The Story of Hargila Conservation in Assam

Oli Borah
Roll No. 24

During our visit to Assam as part of the East India Tour, we had the privilege of interacting with Dr. Purnima Devi Barman, a wildlife biologist whose work has transformed the future of one of the world's most endangered birds- the Hargila, or Greater Adjutant Stork (*Leptoptilos dubius*). This interaction offered deep insights into how conservation can succeed when science, community participation, and cultural values are brought together.The story of the Hargila is not only about saving a species, but about redefining conservation in human-dominated landscapes.

The Hargila: Ecology and Biological Significance

The Greater Adjutant Stork is among the tallest flying birds in the world, with a wingspan of over two metres. It is a wetland-dependent species, closely associated with rivers, floodplains, beels, agricultural wetlands, and marshes. The bird plays a critical ecological role as a scavenger, helping in natural waste disposal and reducing the spread of disease in the environment. Hargila breeds colonially and prefers tall, mature trees for nesting. In Assam, its nesting season usually coincides with the monsoon. Each nest holds one to three chicks, and successful breeding depends on stable nesting trees, minimal disturbance, and safe surroundings. The species mainly nests on trees such as Kadam (*Neolamarckia cadamba*), Semul (*Bombax ceiba*), **and** Dewa (*Alstonia scholaris*). These trees are typically found within or near villages, making human tolerance essential for the bird's survival. Globally, the Greater Adjutant Stork is classified as an Endangered species. Assam, particularly Kamrup district, holds the most significant breeding population in the world today.

Human–Hargila Conflict in the Past

Despite its ecological importance, the Hargila faced severe human hostility in the past. Its large size, scavenging habits, and proximity to villages created fear and misunderstanding. Nesting trees were cut for timber or safety

concerns, nests were destroyed, and fallen chicks often died due to lack of care. This human–wildlife conflict caused a sharp population decline and placed the species on the brink of local extinction.

Dr. Purnima Devi Barman: Education and Vision

Dr. Purnima Devi Barman is a native of Assam and completed her PhD in wildlife biology, focusing on the ecology and conservation of the Greater Adjutant Stork, from Gauhati University. During her doctoral fieldwork, she closely studied the bird's nesting behaviour, feeding ecology, and threats, particularly in Kamrup district. Her research exposed not only biological challenges but also social barriers to conservation. She realised that protecting the bird without changing people's attitudes would never succeed. Leaving behind a purely academic path, she chose to work directly with villages, often facing resistance and criticism in the early years. Her approach was grounded in patience, trust-building, and long-term engagement.

Community, Culture and Women-Led Conservation

A major breakthrough came with the formation of Mangalmai Shanti Jaal, a women-centred conservation network. Dr. Barman identified women as key stakeholders who observe daily changes in nature and influence household decisions. Women began protecting nesting trees, discouraging felling during breeding seasons, rescuing fallen chicks, and spreading awareness within their communities. This initiative later evolved into the Hargila Army, a large group of trained women and youth volunteers who monitor nests, assist in rescue operations, and act as conservation ambassadors.

One of the most innovative aspects of this movement is the integration of local culture and tradition into conservation practice. The Hargila Baby Shower, celebrated during the breeding season, mirrors traditional Assamese ceremonies for newborn children. Villagers gather under nesting trees, sing folk songs, and offer prayers for the healthy growth of Hargila chicks.

This cultural integration created emotional ownership and transformed social attitudes. The bird gradually became a symbol of fertility, continuity, and pride rather than fear.

Fig. Interaction with
Dr. Purnima Devi Barman

Fig. Headgear that resembles the head and neck of the greater adjutant stork

Practical Conservation Interventions

Several field-level interventions strengthened the success of the programme. Nest tree owners were recognised and encouraged, reinforcing positive conservation behaviour. Protective nets were installed below nesting trees to safely catch fallen chicks. Artificial nest platforms were erected where nesting trees were lost or overcrowded. Local volunteers helped in monitoring nests and returning chicks safely. The Passhoo Pakshi website further expanded outreach by sharing conservation stories, data, and awareness material with a wider audience.

Kamrup: A Global Conservation Success

Today, Kamrup district hosts the largest breeding colony of the Greater Adjutant Stork in the world**.** This achievement stands as a global example of successful community-based conservation, achieved without displacement of people or strict exclusionary measures.

The survival of the Hargila in Assam demonstrates that endangered species can coexist with humans when trust, participation, and cultural respect guide conservation efforts.

Awards and Global Recognition

Dr. Purnima Devi Barman's work has received wide national and international recognition. She is a recipient of the Whitley Award (2017), often called the "Green Oscar," for her outstanding contribution to conservation. She has also been honoured as a UNEP Champion of the Earth and received the Padma Shri**,** one of India's highest civilian awards, for her exceptional service to

wildlife conservation. These honours reflect not only scientific achievement but also the power of community-driven conservation.

Learning Outcomes and Implications for Forest Range Officer Trainees

Our interaction with Dr. Purnima Devi Barman taught us that conservation is not only about wildlife, but also about people, empathy, and innovation. Scientific knowledge becomes truly effective when combined with social understanding. Community participation, especially women's leadership, can achieve results that rules alone cannot.

As Forest Range Officer trainees**,** this experience has deep implications for our future roles. It reminds us that effective forest and wildlife management must include local communities as partners. Conflict can be transformed into coexistence when people feel respected, involved, and emotionally connected to conservation goals.

The story of the Hargila shows that even a species once feared and neglected can become a symbol of pride. Guided by the vision and dedication of Dr. Purnima Devi Barman**,** this journey stands as a living example of how conservation can succeed when hearts and minds are won together.

Gethsemane Man-Made Forest: Lessons from a Hand-Raised Forest

Oli Borah
Roll No. 24

Landscapes scarred by floods, conflict and neglect rarely return to life on their own. Yet, at Bhairabkunda in Assam, a forest has risen not by chance, but through human will, collective effort and long-term commitment. Gethsemane Man-Made Forest**,** located within the Bhairabkunda Reserve Forest of Udalguri district near the tri-junction of Assam, Arunachal Pradesh and Bhutan, stands today as a remarkable example of community-driven ecological restoration. Observed during the East India Tour, this hand-raised forest offers enduring lessons in patience, resilience and forest stewardship.
This forest did not grow naturally. It was nurtured tree by tree by local people who believed that restoration was possible even under difficult circumstances. For a Forest Range Officer trainee, it offered insights that no classroom learning could provide.

From Barren Land to Green Cover

The land where Gethsemane now stands was once a thriving forest. However, successive flash floods in 1979 and 1989**,** combined with illegal felling and prolonged socio-political unrest, reduced the area to a vast stretch of rocks, sand and boulders. Rivers such as the Dhansiri and Daifam deposited silt and stones, leaving the soil infertile and vegetation almost completely wiped out.

By the early 2000s, the area had turned into a wasteland, used mainly for grazing. Livelihood opportunities were limited, forcing many young people to migrate in search of work. During this phase, 35 local youths, many associated with the All Bodo Students Union, decided to attempt an alternative path. In 2003, they initially formed a cooperative to explore farming and poultry, but limited experience and poor market access led to unsatisfactory results.

The Turning Point: Community Meets Forestry

A decisive change came with the intervention of Forest Range Officer Naba Kumar Bordoloi, who proposed large-scale afforestation as a sustainable solution. With the support of the Forest Department, six Joint Forest Management Committees (JFMCs) were formed, and a micro-plan was approved under the National Afforestation Programme. Plantation work began between 2005 and 2007 under extremely challenging conditions. The land was rocky, water sources were distant, and access often involved walking or cycling several kilometres daily. Despite these hardships, rocks were cleared, pits were dug and saplings were planted with determination and discipline. To address water scarcity, irrigation channels were dug from the Dhansiri River, ensuring soil moisture during dry months. Over time, embankments were strengthened so that water could reach large portions of the plantation area. These measures significantly improved the survival rate of saplings.

Growth, Setbacks and Resilience

The journey was far from smooth. As the plantation began to succeed, resistance emerged. Instances of arson, driven by suspicion and misinformation, destroyed young plantations more than once. The community responded by organising night patrols, storing water close by and replanting every sapling that was lost.

After the completion of the government-supported phase, financial assistance ended and the original JFMCs were dissolved. At this crucial moment, the members chose not to abandon the forest they had raised. Instead, they came together to form the Gethsemane Joint Forest Management Committee, taking full responsibility for protection and continued plantation activities.

By 2024, more than 14 lakh saplings had been planted across approximately 750 hectares, including timber species such as gamari, segun, sishu, khoyar and simalu, along with bamboo and fruit-bearing species. Gradually, wildlife returned—deer, wild boar, reptiles, birds and even elephants, signalling the restoration of ecological balance.

A Living Forest and a Learning Landscape

Today, Gethsemane is a self-sustaining forest with flowing streams, regenerating understorey and increasing biodiversity. The community has

cautiously introduced eco-tourism, offering limited homestay facilities and traditional cuisine, while consciously avoiding mass tourism that could disturb the tranquillity of the forest.

Innovative livelihood options such as beekeeping with the native honeybee *Apis cerana*, fishery and melliponiculture have been explored, successfully blending conservation with income generation. The forest has also emerged as a model for similar initiatives, inspiring projects such as the Dhansiri–Sikaridanga JFMC.

The efforts of the Gethsemane community have received national recognition, including the Lifetime Achievement Award by the Kaziranga Wildlife Society (2016) and the Eastern Himalayan Conservation Award by the Balipara Foundation (2017).

Fig. Interaction with JFMC members

Fig. Mature forest growth

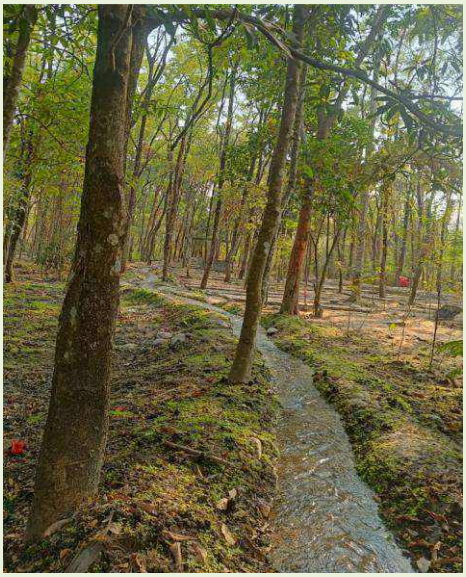


Fig. Canal-based Moisture Management

Lessons for a Forest Range Officer Trainee

Gethsemane offers profound lessons for a Forest Range Officer trainee. It demonstrates that forest restoration is as much a social process as an ecological one. Technical interventions succeed only when local communities are treated as equal partners. The role of the forest officer here was not merely administrative, but catalytic- facilitating institutions, encouraging ownership and supporting communities through difficult phases.

The story also highlights the importance of post-project sustainability. True success begins when external funding ends and local stewardship takes over. Continuous protection remains essential, as regenerated forests face emerging threats such as timber theft and forest fires. Most importantly, Gethsemane teaches that degraded landscapes are not lost forever. With patience, community participation and ethical leadership, even severely damaged ecosystems can be restored.

A Hope Raised by Human Hands

Gethsemane Man-Made Forest stands today as a symbol of hope, born from hardship, sustained by unity and protected through commitment. This experience reaffirmed the belief that conservation is not confined to protected areas alone. It lives in people, in partnerships and in the quiet persistence of those who choose to rebuild rather than abandon. This hand-raised forest is not just a success story of Assam; it is a guiding light for community-based forestry across the country.

Gibbon Wildlife Sanctuary: A Hidden Treasure of Nature

Dravida Krishnatreya
Roll No. 06

Deep within the cradle of Assam's fertile plains, where the tea gardens yield to a dense, emerald embrace, lies a sanctuary that breathes with the rhythm of the ancient world. This is Hoollongapar, the Gibbon Wildlife Sanctuary—a fragment of a lost horizon, stitched together by the towering canopy of the *Hollong* trees.

To enter here is to step out of time. The air is heavy, a humid perfume of damp earth, decaying leaves, and the sweet, musk-scented breath of wild orchids. It is a world governed by the vertical; while we walk the leaf-littered floor, the true pulse of the forest beats sixty feet above our heads

The Morning Call

As the first silver threads of dawn pierce the mist, the silence is shattered by a sound that is both haunting and holy. It is the Vocal Symphony of the Hoolock Gibbon.

It begins as a low trill, rising into a frantic, rhythmic duet between mate and kin. This is no mere noise; it is a declaration of presence, a territorial map drawn in the air. The Gibbons—tailless acrobats of the sky—move like shadows through the upper tiers. With arms longer than their bodies, they defy gravity, swinging in great, looping arcs called *brachiation*. To watch them is to see fluid motion personified; they do not merely move through the trees, they become a part of the wind.

A Tapestry of Seven

Hoollongapar is a rare jewel, a sanctuary that holds the unique distinction of sheltering **seven distinct species of primates**. While the Gibbon is the crown prince, the court is filled with diverse nobility:

- **The Capped Langur:** Draped in pale gold and grey, watching the world with contemplative, kohl-rimmed eyes.
- **The Pig-tailed Macaque:** Bustling through the mid-canopy with a short, curled tail and an air of perpetual business.
- **The Stump-tailed Macaque:** Robust and earth-bound, their faces flushed a deep, sunset red.
- **The Rhesus and Assamese Macaques:** The clever sentinels, ever-watchful and quick.
- **The Slow Loris:** A ghost of the midnight hours, with massive, reflective eyes that find light where there is only shadow.

The Lowland Rhythm

Below the canopy's riotous life, the forest floor tells a different story. The Hoollongapar is a lowland semi-evergreen forest, a dense thicket where the sun struggles to reach the moss. Here, the Elephants pass like grey clouds through the undergrowth, their heavy footsteps muffled by the soft mud.

The sanctuary is an island of wildness surrounded by a sea of humanity. The railway track that bisects the woods is a reminder of the modern world's encroachment, yet the forest persists. It is a testament to the resilience of the

wild—a place where the Malayan Giant Squirrel leaps like a flame between branches and the Emerald Dove flits through the shadows like a living jewel.

A STRUGGLE FOR PROTECTION:

To protect the fragile ecosystem of Hoollongapar, a coordinated effort between the government, local communities, and scientific organizations like Aaranyak has been established. These measures focus on mending a fragmented landscape and shielding its inhabitants from the pressures of modern industry.

1. Mending the Canopy: Natural Bridges

The most critical challenge at Hoollongapar is the railway track that splits the sanctuary in two. Because Hoolock Gibbons are strictly arboreal (tree-dwelling), they cannot cross open ground without facing extreme danger

Artificial Bridges: Initially, metallic and rope-based "canopy bridges" were installed. However, the gibbons were hesitant to use these unnatural structures.

Natural Corridors: In a breakthrough project starting in 2006, conservationists planted over **3,000 native trees** (including *Hollong* and *Nahar*) along a one-kilometer stretch of the railway. In 2019—after 13 years of growth—the branches finally met, creating a **natural canopy bridge**. For the first time in over 130 years, gibbons were recorded crossing the tracks to reunite with isolated family groups.

2. Legal and Industrial Safeguards

The sanctuary is protected under the **Wildlife Protection Act, 1972**, granting its inhabitants the highest level of legal security.

Eco-Sensitive Zone (ESZ): A buffer area of approximately **265 km^2** surrounds the sanctuary to prevent industrial encroachment.

Recent Interventions: As of 2024–2025, the National Board for Wildlife (NBWL) has faced intense scrutiny regarding oil exploration nearby. Conservationists have successfully pushed for strict conditions: no commercial extraction within the ESZ and mandatory digital surveillance to ensure minimal impact during exploratory phases.

3. Community and Frontline Support

Conservation here is a human endeavor as much as a biological one.

Training Guardians: Organizations provide "Leech guards," GPS units, and field kits to forest guards. This not only aids in tracking but also builds professional pride among the frontline staff who patrol the dense, wet terrain.

Education: Local communities and tea garden workers are engaged through awareness programs to reduce the use of forest wood and prevent human-wildlife conflict, particularly with the elephant herds that frequent the area.

The Guarded Legacy

As evening descends, the gibbons grow quiet, tucking themselves into the high forks of the trees. The forest transitions from the frantic energy of the day to the velvet mystery of the night. Hoollongapar is more than a sanctuary; it is a genetic library, a sanctuary for the "singing apes" who remind us of our own ancient, arboreal heritage.

To stand in the heart of this Assam glade is to feel small, yet connected. It is a reminder that as long as the Hoolock calls to the rising sun, the spirit of the wild remains unbroken.

Gir National Park: A Jewel of Wildlife Conservation and the Role of Technology in Modern Protection

Daisy Baishya

Roll No: 05

As part of the Central West Tour, we had the opportunity to visit Gir National Park on 28th and 29th July 2025. Gir National Park, located in the Junagadh district of Gujarat, is globally renowned as the only natural habitat of the Asiatic lion. The visit was an enriching blend of wildlife exploration, ecological learning, and environmental awareness.

During the two-day visit, we were introduced to the park's unique ecosystem, diverse flora and fauna, and the ongoing conservation efforts undertaken by forest authorities. The tour included guided sessions, field observations, and interactions with experts, which provided a deeper understanding of wildlife management, biodiversity conservation, and the delicate balance between nature and human activity. This visit was not just a journey through a forest but a meaningful learning experience that strengthened our appreciation for India's natural heritage.

Gir National Park and Wildlife Sanctuary, located in the Saurashtra region of Gujarat, India, is one of the most iconic wildlife reserves in the world. It is globally renowned as the last natural habitat of the Asiatic lion (*Panthera leo persica*), a species once on the brink of extinction. Spread across thousands of square kilometers of dry deciduous forest, Gir harbours a rich diversity of wildlife and is a symbol of India's successful conservation efforts. Beyond lions, the park shelters leopards, striped hyenas, jackals, deer species, and a variety of birdlife, making it a vibrant ecological landscape. The stewardship of such a precious ecosystem increasingly relies on advanced technology, driven by the Gir Hi-Tech Monitoring Unit — a pioneering initiative tasked with enhancing scientific monitoring, management, and protection.

The Gir Hi-Tech Monitoring Unit: Harnessing Technology for Conservation

Established in June 2019, the Gir Hi-Tech Monitoring Unit at *Sasan-Gir* serves as a technological nerve centre for wildlife conservation across the Gir landscape. It integrates cutting-edge tools and systems to monitor animal movements, human impacts, forest activities, vehicle movements, and ecological trends — all in real-time. The Unit's mandate extends from scientific research and data analytics to regulatory monitoring, enabling forest managers to make informed decisions that balance conservation and human interests.

Key Technologies Used in Gir Hi-Tech Monitoring

1. Radio Telemetry for Wildlife Tracking

The unit uses radio telemetry systems, where select wild animals — including lions and leopards — are fitted with radio collars that transmit their real-time location data. This provides crucial insight into movement patterns, home ranges, habitat usage, and potential human-wildlife conflict zones. Such data supports management interventions and helps in proactive conflict mitigation.

2. Avian Telemetry for Bird Monitoring

Beyond large carnivores, avian telemetry is used to track movements of various bird species fitted with solar-powered satellite transmitters. This technology helps researchers study migration patterns, foraging behaviour, and habitat preferences, thereby aiding in comprehensive ecosystem management.

3. AI-Powered Photo Identification (SIMBA)

One of the most innovative tools in Gir's tech arsenal is SIMBA — Software with Intelligent Marking Based identification of Asiatic Lions. Developed using deep machine learning, SIMBA analyzes unique whisker-spot patterns, facial scars, and ear notches to automatically identify individual lions from photographs. This non-invasive method allows scientists to build detailed demographic and behavioural databases without the need for physical handling.

4. e-GujForest Forest Management Information System

The e-GujForest app is an Android-based field data capture system used by forest staff to record information such as wildlife sightings, incidents, injuries, forest offences, and management interventions. It enables offline data capture with later synchronization and links to GIS interfaces for mapping and analysis. This digital approach significantly improves data accuracy and accessibility.

5. Surveillance and Communication Networks

A dedicated wireless communication network supports real-time information flow among frontline staff. Equipped with digital handheld radios and vehicle sets, the system ensures seamless coordination even in remote regions. Additionally, CCTV surveillance at check posts, entry/exit points, and along tourist routes provides continuous monitoring for both security and compliance with park rules.

6. Safari Vehicle GPS Monitoring

Eco-tourism vehicles (safari gypsies) operating within the park are fitted with GPS devices that continuously broadcast their location to the monitoring unit. This enhances visitor safety, tracks movement patterns, and ensures tourists adhere to predefined routes — minimizing ecological disruption.

7. Speed and Wildlife Detection Monitoring

To prevent animal-vehicle collisions, especially along highways near wildlife zones, Gir has deployed an advanced speed monitoring and detection system. It uses sensor-based speed radars, thermal and optical cameras, and Automatic Number Plate Recognition (ANPR) to alert drivers and authorities about speeding vehicles and detected wildlife on or near roads. When animals are detected, real-time alerts such as “Wildlife Ahead” are displayed on LED screens and transmitted to forest check posts and the monitoring unit, helping reduce road fatalities.

Benefits and Impact of Technology in Gir

The integration of modern technology through the Gir Hi-Tech Monitoring Unit has revolutionized wildlife conservation in the region. Some key benefits include:

- **Enhanced wildlife protection:** Real-time monitoring allows rapid response to threats, reducing mortality from poaching, accidents, or conflicts.
- **Data-driven management:** Detailed telemetry, GPS, and digital reporting inform evidence-based decision-making for sustainable conservation.
- **Human-wildlife coexistence:** Systems like speed monitoring and communication networks improve safety for both animals and local communities.
- **Improved research and understanding:** Tools like SIMBA and avian telemetry broaden scientific knowledge about species behaviour and ecosystem dynamics.

Gir National Park stands as a living testament to wildlife conservation, particularly for the Asiatic lion. What once relied solely on traditional ranger patrols and manual surveys has evolved into a highly sophisticated, technology-driven conservation model. The Gir Hi-Tech Monitoring Unit exemplifies how innovation and science can strengthen protection efforts, improve animal welfare, and support harmonious coexistence between humans and wildlife. As this model continues to expand, it offers a template for modern conservation practices not just in India but across the world.

Fig. Asiatic Lion sighted in the Devalia Safari Park,Gir National Park

Gulmarg – Meadow of flowers

Kulumanali Gogoi
Roll No: 14

Gulmarg means “Meadow of Flowers”, is a famous hill destination located in the Baramulla district of Jammu and Kashmir. It lies in the Pir Panjal range of the Western Himalayas at an average altitude of about 2,650 metres above sea level. True to its name, Gulmarg is known for its vast green meadows that bloom with colourful flowers during spring and summer, creating one of the most beautiful natural landscapes in India. Gulmarg was discovered as a tourist destination in the 19th century during the Dogra rule. Later, during the British period, it became a reminder for colonial officers because of its cool climate and scenic beauty. Gulmarg also has historical importance as it was once used as a summer resort and a grazing ground for local shepherds (Gujjars and Bakarwals). The meadow supports rich temperate and alpine flora due to fertile soil, adequate rainfall, and suitable climate. Common flowers found in Gulmarg: daisies, buttercups, bluebells, forget-me-nots, gentians, crocus & wild roses. 361 species of medicinal and aromatic plants also grow naturally in the meadow out of which 81 species are endemic to the Himalayas.

Gulmarg Wildlife Sanctuary is one of the most important protected areas of Jammu and Kashmir, located in the Baramulla district of the Union Territory. Nestled in the Pir Panjal range of the Western Himalayas, the sanctuary surrounds the famous hill resort of Gulmarg, known worldwide for its scenic beauty and winter sports. The sanctuary plays a vital role in conserving Himalayan biodiversity while also supporting eco-tourism. Gulmarg Wildlife Sanctuary was established in 1987 to protect the rich forest ecosystem and wildlife of the Gulmarg region. Before being declared a sanctuary, the area was part of reserved and protected forests used for grazing and timber. Increasing tourism pressure and habitat disturbance highlighted the need for legal protection, leading to its notification as a wildlife sanctuary under the Wildlife (Protection) Act, 1972. The sanctuary ranges from about 2,300 m to over 4,200 m above sea level with an area of 180 sq km.

Importance of Gulmarg Wildlife Sanctuary

The sanctuary is important for several reasons. The sanctuary plays a significant role in conservation of Himalayan flora and fauna, about 81 species of medicinal plants are endemic to this region. Gulmarg also act as protection of watershed areas and prevention of soil erosion (Rhododendron acts as soil binder). Provides habitat for threatened and endangered species such as *Pinus griffithii*, *Taxus wallichiana* and *Picea smithiana*. Also acts as an ecological buffer around Gulmarg tourist area and supports eco-tourism and local livelihoods.

Flora (Vegetation): Gulmarg Wildlife Sanctuary is dominated by temperate and alpine forests. Major species are: Kail (*Pinus wallichiana*), Fir (*Abies pindrow*), Spruce (*Picea smithiana*), Deodar (*Cedrus deodara*) (in lower areas), Birch (*Betula utilis*) at higher altitudes, Alpine grasses and medicinal herbs in upper zones.

Major forest types: Coniferous forests, Mixed temperate forests, Alpine meadows

Fauna (Wildlife): The sanctuary supports a wide range of mammals and birds, many of which are rare or threatened: Hangul (*Cervus elaphus hanglu*) (rare & endangered), Himalayan Black Bear (*Ursus thibetanus*), Brown Bear (*Ursus arctos*), Leopard, Musk Deer (*Moschus leucogaster*), Himalayan Serow (*Capricornis sumatraensis*), Langur, Himalayan Marmot (*Marmota himalayana*).

Birds: Himalayan Monal (Lophophorus impejanus), Koklass Pheasant (Pucrasia macrolopha), Snow Partridge (*Lerwa lerwa*), Golden Eagle (*Aquila chrysaetos*), Bearded Vulture (*Gypaetus barbatus*), Griffon Vulture (*Gyps fulvus*) (94 species bird are recorded).

Fig. a: *Abies pindrew*, b: *Picea smithiana*, c: *Pinus wallichiana*, d: *Cedrus deodara*

Conservation Efforts & tourism

The Jammu & Kashmir Forest Department is responsible for managing and protecting the sanctuary. Regular patrolling and anti-poaching camps, Habitat protection and prevention of forest fires, Regulation of grazing and resource extraction, Wildlife monitoring and census, Awareness programs for local communities and tourists, Coordination with tourism authorities to control disturbance. Despite protection, the sanctuary faces several challenges like Tourism pressure from Gulmarg resort area, habitat fragmentation, illegal grazing, human-wildlife conflict & climate change. To address these challenges, the Forest Department has taken the steps: demarcation of core and buffer zones; regulation of tourist movement inside sensitive areas; promotion of eco-tourism guidelines; involvement of local

people in conservation activities; awareness campaigns to reduce human–wildlife conflict.

Gulmarg Wildlife Sanctuary greatly enhances the tourism value of the region. Adds nature and wildlife tourism to Gulmarg's adventure tourism. Attracts birdwatchers, nature lovers, researchers & provides opportunities for eco-tourism, trekking & other adventure sports. A part of the sanctuary has been handed to the tourism department allowing Gondla cable car rides, horse riding & trekking to the snow-covered mountains of Gulmarg. Plays a significant role in livelihood generation to local communities through guides, homestays, and services Healthy forests and wildlife make Gulmarg a complete tourism destination, combining recreation with conservation.

Gulmarg Wildlife Sanctuary is a valuable natural heritage of the Western Himalayas. It plays a crucial role in biodiversity conservation, ecological balance, and sustainable tourism. While challenges like tourism pressure and climate change exist, effective management by the Forest Department and responsible behaviour by visitors can ensure long-term protection of this unique ecosystem. Conserving Gulmarg Wildlife Sanctuary is essential not only for wildlife but also for the future of tourism and environment in the region.

Fig. Cable car & Meadows of Gulmarg

High Altitudinal Nursery Management: Lessons Learnt from Katra & Kralsangri Hi-Tech Nursery

Kulumanali Gogoi
Roll No:14

High altitudinal nursery management refers to the raising of forest planting material at high elevations, generally 1,500–2,000 metres above mean sea level. Such nurseries are essential for afforestation, reforestation, eco-restoration, and conservation works in Himalayan and other mountainous regions, where climatic conditions are harsh and normal nursery techniques are not suitable. On our North India study tour program, we came across three such high-altitudinal nurseries High-Tech nursery of Mata Vaishno Devi shrine board (Katra), High Tech Conifer nursery (Kralsangri) & Sisso valley nursery. Kralsangri high tech nursery produces 1 to 2 lakhs of saplings every year for plantation across Jammu & Kashmir.

Characteristics of High-Altitude Areas

High altitude regions have special environmental conditions such as low temperature and long winter followed by frost & snowfall. Short growing season & strong winds; intense solar radiation and UV exposure; shallow and less fertile soils. These factors directly influence nursery practices.

Objectives of High Altitudinal Nurseries

a) Production of hardy, site-specific planting stock.
b) Supply planting stock for high altitude plantations.
c) Conservation of rare and endangered plant species.
d) Support watershed management and soil conservation.
e) Restoration of degraded alpine and sub-alpine areas.

Site Selection

Proper site selection is very important for establishing a successful high-tech nursery at high altitude. Site should have gentle slope with south-eastern aspect; protection from cold winds and avalanches; availability of water source; well-drained soil rich in organic matter & accessibility during the short working season.

Selection of Species

Species should be local, frost-hardy, and slow-growing. Common species raised in Katra & Kralsangri Hi-Tech nursery are:

Conifers: Deodar (*Cedrus deodara*)**,** Kail (*Pinus wallichiana*)**,** Fir (*Abies pindrow*)**,** Spruce (*Picea smithiana*)

Broad-leaved species: Birch (*Betula utilis*), Alder (*Alnus nepalensis*), Maple (*Acer spp.*)

Shrubs and grasses: Willow (*Salix spp.*), Sea buckthorn (*Hippophae rhamnoide*

Some other species such as *Ginkgo biloba* (living fossil), *Robinia pseudoacacia,Milia dubia* are also raised in Kralsangri nursery of Kashmir.

Nursery Bed Preparation

Raised beds of size 1-1.2 m wide & 10 m length are preferred to avoid waterlogging & easy operation. The potting media consists of: forest soil + sand + FYM/compost in the ration of 2:2:1. 2-3 seeds are put per polybag.

Sowing and Germination:

Seeds are collected from local high-altitude sources. Seed treatment is done to break dormancy by stratification or soaking in hot & cold water. Sowing time is late spring to early summer. Light mulching with pine needles or dry grass or covered by polythene sheet for 45 days during snowfall time. Shade is provided during early stages for protection from scorching sunlight.

Watering and Nutrient Management

Watering should be light but regular watering is required. Organic manures such as vermicompost are preferred instead of chemical fertilizers.

Protection Measures

Seedlings need special protection from frost covered by polythene tunnels. Windbreaks are used as fencing or live hedges. Snow damage is prevented by temporary shelters.

Hardening of Seedlings

Hardening is crucial before transplanting to main field. Gradual exposure to cold wind, reduced watering, removal of shade strengthens seedlings for field conditions.

Lifting, Transport and Planting

Seedlings are lifted carefully with intact root system for transportation during cool hours. Planting is done immediately after snowmelt, preferably

Mata Vaishno Devi Shrine Board (SMVDSB) nursery runs a major high-tech nursery in Panthal near Katra, primarily for afforestation but also provides native plants to pilgrims as eco-friendly souvenirs, a concept called "**Vaishnavi Vatika**". The nursery promotes environmental conservation by offering plants as **live prasad** to devotees. The board established the nursery with a goal to integrate spirituality with ecological responsibility, a major focus of SMVDSB. The high-tech nursery is equipped with **Controlled mist chamber** that regulates temperature, humidity & aeration to create optimal conditions for seedling propagation & year-round growth. There are two poly **greenhouses** and a naturally ventilated poly greenhouse to protect young plants from external conditions & support healthy growth.

Advanced Fogging System: Used for watering nursery plantlets uniformly and efficiently, reducing irrigation loss. Reusable root trainers & growing media. The nursery has a natural spring water source & large underground storage tank to ensure reliable water supply for irrigation & nursery operations. Interpretation centre: An interpretation centre with seed banks of the native species.

Fig. Mata Vaishno Devi Shrine Board Nursery

Fig. Mata Vaishno Devi Shrine Board Nursery

High altitudinal nursery management requires special techniques, careful planning, and site-specific practices. Challenges are more due to short working season, high mortality due to frost, difficulty in transportation & limited availability of skilled labour. Well-managed high-altitude nurseries are key to successful afforestation and ecological restoration in mountain ecosystems. Adoption of scientific nursery practices and use of local species can ensure higher survival and sustainable forest development in high altitude areas. The techniques used in high-altitude nurseries can be adopted in Assam, but with modifications to suit Assam's humid & high rainfall conditions. With proper ventilation, drainage, indigenous species selection & modern nursery tools, these techniques can improve plantation in Assam also.

Jatayu Conservation Breeding Centre — Safeguarding Asia's Vultures

Kulumanali Gogoi
Roll No: 14

Vultures are the large scavenging birds that play a very important role in nature. They mainly feed on dead animals (carcasses) and help keep the environment clean. Because of this role, vultures are often called "nature's sanitation workers." Vultures belong to the order Accipitriformes (Old World vultures) and Cathartiformes (New World vultures). India is home to Old World vultures, which are found in forests, grasslands, agricultural areas, and near human settlements: White-rumped Vulture (Gyps bengalensis) – Critically Endangered Indian Vulture, Critically Endangered- Slender-billed Vulture (Gyps tenuirostris), Long-billed Vulture (Gyps indicus), Himalayan Griffon, Egyptian Vulture. Vultures are characterized by broad wings for soaring long distances, strong beaks for tearing flesh, bald or featherless heads to stay clean while feeding.

Vultures provide many ecological and social benefits: Carcass disposal, disease control (by eating carcasses, they prevent the spread of diseases like anthrax and rabies); they maintain food chain balance & reduces cost of carcass disposal in rural areas. Major causes of Vulture population decline in India after 1990s are due to: use of a veterinary drug diclofenac, habitat fragmentation, electrocution & collisions with power lines & food scarcity. To save vultures, several conservation steps have been taken in India such as: ban on veterinary diclofenac (2006); Promotion of safe alternatives like Meloxicam; Establishment of Vulture Conservation Breeding Centres (e.g., Pinjore, Haryana); Vulture Safe Zones (VSZs) in many states & awareness programs for farmers and veterinarians.

We the 11th Batch FRO trainees visited the Jatayu Conservation Breeding Centre (JCBC) centre on our North India Study Tour program & got highly motivated by their works towards vulture conservation. Perched on the edge of Bir Shikargah Wildlife Sanctuary near Pinjore (Panchkula district, Haryana), the Jatayu Conservation Breeding Centre (JCBC) is India's and Asia's— flagship facility dedicated to rescuing, breeding and re-introducing critically

endangered Gyps vultures. Named after Jatayu, the mythical vulture of the Ramayana, the centre combines government stewardship, scientific research and NGO partnership to reverse one of the steepest bird declines in recent history. The facility began in 2001 as a "Vulture Care Centre" and was later upgraded and formally named as "Jatayu Conservation Breeding Centre" in 2004. The centre was set up by the Haryana Forest Department in collaboration with the Bombay Natural History Society (BNHS), with additional technical support from international conservation partners (including the Royal Society for the Protection of Birds in earlier years). The initiative grew out of urgent concern in the early 2000s when vulture numbers across South Asia collapsed.

Why JCBC was needed — the crisis that prompted action

During the 1990s and early 2000s India experienced catastrophic declines in Gyps vultures (white-rumped, long-billed/Indian, and slender-billed species), with population losses over 95% in affected areas. Research undertaken by Indian conservationists—including scientists associated with JCBC and BNHS—found veterinary use of the anti-inflammatory drug diclofenac in

livestock as a primary cause: vultures feeding on carcasses of treated cattle suffered fatal kidney failure. This discovery directly contributed to India's ban on veterinary diclofenac in 2007–08 and became a central rationale for large-scale captive breeding and release programs. Other than diclofenac, NSAIDs drugs: kitoprofen, triclofenac, nimudulide, flunixin & acelofenac are also found responsible for decline in vulture population.

Species at Jatayu Conservation & Breeding Centre

JCBC houses the following four species, three critically endangered and one threatened, for breeding and conservation:

Critically endangered species:

a) Indian vulture, (*Gyps indicus*, formerly known as the long-billed vulture)
b) Slender-billed vulture, (*Gyps tenuirostris*, formerly classified under the long-billed vulture; 97% have been wiped out by diclofenac)
c) White-rumped vulture, (*Gyps bengalensis*, formerly known as the oriental white-backed vulture; 99.9% have been wiped out by diclofenac)
d) Threatened species: Himalayan vulture (*Gyps himalayensis*)

The centre's mission & core activities

a) **Ex-situ breeding:** Establish and maintain self-sustaining captive populations of critically endangered Gyps species.
b) **Research & monitoring:** Study vulture biology, breeding ecology, causes of decline (pharmacovigilance), and post-release survival—information that informs national policy and field interventions.
c) **Rehabilitation & release:** Rescue poisoned or injured wild vultures, rehabilitate them, and when safe, release birds back into suitably safeguarded wild areas after acclimatization.
d) **Capacity building & networking**: Serve as a national hub in the SAVE (Saving Asia's Vultures from Extinction) network and cooperate with other breeding centres and state forest departments to exchange birds for genetic diversity and to scale up releases.

Notable techniques & innovations used at JCBC

Artificial incubation and managed pairing: To accelerate reproduction in species that breed slowly in captivity, JCBC uses artificial incubation and

carefully managed breeding protocols—doubling breeding output compared with initial rates in some seasons.

Phased wild-like acclimatization: Birds bred or rehabilitated at JCBC are kept in progressively wild-like enclosures within the sanctuary to encourage natural behaviour prior to release. Visitors are not allowed there.

Satellite telemetry: JCBC began Asia's first program of satellite-tracking released vultures—fitting lightweight transmitters to monitor post-release movements, survival and habitat use, enabling rapid response if a tracked bird stops moving. Transect surveys, identification of nesting colonies & monitoring of feeding sites, Livestock Caracas Sampling & Gaushala awareness program.

1. JCBC is equipped with Housing facilities such as Quarantine Aviary (Isolation), Colony Aviary (Social Flying), Nursery Aviary (Natural Nest), Hospital Aviary (Medical Care), Display aviary, Breeding aviary.
2. **Laboratory and Veterinary Care Facilities:** Clinical Care Room (12x10x10'), Critical Care Room, Recovery Aviary, Brooder Room, Incubator Room, Molecular Room, Haematology Room, Freezer Room & Monitoring Room.

Major achievements & impact

Policy impact: JCBC's research helped confirm diclofenac's role in the vulture crash and supported the Government of India's veterinary ban on the drug (2007–08), a milestone for vulture recovery efforts.

Breeding scale-up: From its early years of a few dozen birds, JCBC grew to host hundreds of vultures—reported figures show substantial annual increases (e.g., ~250 vultures recorded around 2017) and steady captive breeding success. The centre has produced dozens of captive-bred nestlings and fledglings and has transferred birds to other breeding centres to spread genetic stock.

Vulture Safe Zone: 100 km radius around breeding sites of Gyps vulture are designated as VSZ with objective to protect colonies, habitats & toxic veterinary drug free zones. VSZ is formed to reintroduce captive bred vultures into the wild.

First regional releases & tracking: JCBC began Asia's first systematic releases (from 2016) and pioneered satellite-tracking of released individuals (first tracked releases reported from 2017 onward), providing the first robust data on post-release survival and movement.

Community Participation: To aware people about harmful effects of NSAID drugs on vulture & to encourage people to use only Meloxicam & Tolfenamic acid (safe alternative drugs).

Conclusion

Despite the ban on veterinary diclofenac, unsafe drugs (e.g., ketoprofen, aceclofenac) and misuse still exist in parts of the region and pose ongoing threats. Ensuring safe carrion availability, expanding protected release sites, maintaining genetic diversity, and continued community outreach (to reduce use of harmful drugs and to reduce persecution) remain priorities. JCBC's role in monitoring, advocacy and training continues to be essential for long-term recovery. The Jatayu Conservation Breeding Centre at Pinjore stands as a rare conservation success story: a place where rigorous science, coordinated policy influence and hands-on aviculture combine to give critically endangered vultures a second chance. While recovery is a long road, JCBC's breeding successes, pioneering releases and national leadership make it central to any hope that Gyps vultures will once again reclaim their ecological role across South Asia.

Fig. Facilities available at Jatayu Conservation & Breeding Centre

Fig. Facilities available at Jatayu Conservation & Breeding Centre

Kaziranga Orchid and Biodiversity Park (Assam) - Its contribution in Biodiversity Conservation

Priyanka Hatimata
Roll No-26

Kaziranga Orchid and Biodiversity Park is located near Kaziranga National Park, Golaghat district, Assam. It was stablished in 2015 and area is ~6 acres. The park is India's largest orchid park and over 500 species of orchids (including many natives to Northeast India) is found in it.

Best time to visit: October–April, entry timing: 9:00 AM – 6:00 PM. The orchid park displays of medicinal plants, bamboo species, and rare flora. Replicas of traditional Assamese houses representing different tribes and daily cultural shows like Bihu, Jhumur, other folk dances. There is a butterfly garden and biodiversity interpretation zone. This park is a perfect add-on to a Kaziranga safari trip, offering both biodiversity education and cultural immersion

Key attractions like

- Orchidarium: Seasonal blooms showcasing Assam's rich orchid diversity
- Ethnobotany section: Traditional uses of plants by local communities
- Cultural arena: Live performances highlighting Assam's heritage
- Souvenir & local food stalls: Handicrafts, Assamese snacks

Importance of Kaziranga Orchid and Biodiversity Park

It has a great role in conservation of Orchid Diversity which protects and displays 500+ orchid species, many native and rare to Northeast India. The park supports ex-situ conservation of threatened and endemic plants. Ther is a biodiversity Awareness & Education acts as a living classroom for students, researchers, and visitors also visit to Kaziranga Orchid and Biodiversity Park

helped us understand the importance of plant diversity, conservation, indigenous knowledge, and sustainable eco-tourism in North-East India.

It promotes understanding of orchids, medicinal plants, bamboo, and local ecosystems. It has a major role of support to Kaziranga Ecosystem and focuses mainly on fauna. Ther is a museum and waving centre which preserves Indigenous Knowledge and showcases traditional Assamese houses and ethnobotanical practices. It also helps document and transmit tribal knowledge on plant uses. Promotion of Cultural identities like daily folk dance and music performances strengthen Assamese cultural diversity and provides a platform for local artists and traditions. Promotion of eco-tourism & Local Livelihoods generates employment for local communities like guides, performers, artisans etc. It has a great contribution to promotes sustainable tourism linked with Kaziranga visits. The park is a major platform for Research & Training and useful for forestry, botany, and wildlife students for field exposure by supporting documentation of orchid species and conservation techniques.

Contribution of Kaziranga Orchid and Biodiversity Park in North-East India

Conservation of North-East Floral Wealth- The park protects and showcases orchids native to the North-East, a global orchid hotspot also conserves rare, endemic, and threatened species through ex-situ conservation, strengthening Regional Biodiversity Awareness, educates visitors about the unique ecosystems of North-East India, and builds conservation ethics among students, tourists, and local communities.

Promotion of Indigenous Culture & Knowledge- it represents tribes and ethnic groups of the North-East through traditional houses and practices also preserves ethnobotanical knowledge linked to orchids and medicinal plants.

From our visit we have learned about the variety, structure, and seasonal flowering of orchids also understood the importance of native and endemic

species why it is important for ex-situ conservation, also understood how human activities affect plant diversity. We also learned how local tribes use medicinal plants, bamboo, and orchids in daily life, gained knowledge for traditional ecological knowledge. The park reflects the grate role of Flora–Fauna Relationship and indicated that conservation is not only about animals, but also about plants that support ecosystems. Assamese and North-Eastern folk traditions, dances, and lifestyle reflect how culture and biodiversity are interconnected. We observed community participation in park management and felt motivated to contribute towards conservation efforts also learned how responsible tourism supports conservation and local livelihoods.

Description of the Specimens found in Orchid Park:

Rhynchostylis retusa (Foxtail Orchid): Foxtail Orchid is the State flower of Assam. It is a Indicator of good forest health and humidity having long, drooping flower spikes. It is widely found in Kaziranga landscape due to humid climatic condition.

Vanda coerulea (Blue Vanda): Rare and highly valued orchid, known for its blue to violet flowers and it requires pristine forest conditions. It is a symbol of biodiversity richness of Northeast India

Dendrobium nobile: One of the most common native orchids grows on tree trunks and rocks and it has important medicinal and ornamental species, reflects seasonal climatic suitability.

Paphiopedilum fairrieanum (Slipper Orchid): This species is endangered and rare also called as ground-dwelling (terrestrial) orchid. It is very sensitive to habitat disturbance and so indicator of undisturbed forest ecosystems.

Cactus Species Found in Kaziranga Orchid Park

Although Kaziranga Orchid Park mainly focuses on orchids, it also maintains a cactus and succulent section for education and conservation. The commonly displayed cactus species include:

Opuntia ficus-indica (Prickly Pear Cactus): Flat, paddle-shaped stems highly drought tolerant having xerophytic adaptation, It is used globally for fruit and soil conservation

Echinopsis species: Round to cylindrical cactus, known for large, beautiful night-blooming flowers, popular ornamental cactus, shows adaptation to low water availability.

Cactus species demonstrate plant survival strategies in extreme conditions. They are useful for environmental education, ex-situ conservation, and eco-tourism, contrast well with orchids, highlighting ecosystem diversity.

Medicinal Plants in Kaziranga Orchid & Biodiversity Park

Along with orchids, the park conserves many important medicinal plants of Assam and Northeast India for awareness and ex-situ conservation.

Tulsi (Ocimum sanctum): Used for cough, cold, fever, immunity, antibacterial and antioxidant, used as sacred and widely used in Ayurveda.

Aloe vera: Used for burns, skin diseases, digestion, anti-inflammatory and healing properties and important medicinal succulent.

Neem (Azadirachta indica): Used in skin disorders, dental care, blood purification, strong antimicrobial properties and natural pesticide medicinal tree

Ashoka (Saraca asoca): Bark used in gynecological disorders, important Ayurvedic medicinal tree and an indicator of conserved forest habitat.

Kaziranga Orchid & Biodiversity Park stands out as a living classroom of conservation, uniquely blending in-situ inspiration with ex-situ protection. Unlike conventional botanical gardens, it represents the entire ecological story of Northeast India from orchids and medicinal plants to cactus, bamboo, fish, birds, and traditional tribal knowledge. It conserves rare, endemic, and threatened orchids, which act as bio-indicators of forest health. Also safeguards ethnomedicinal plants, preserving indigenous knowledge systems alongside plant diversity. The park reduces pressure on wild populations through ex-situ conservation, promotes community participation and eco-tourism, creating conservation-linked livelihoods and also acts as a capacity-building platform for students, forest trainees, and researchers.

Kheerganga Trek Experience

Part of Our North India Study Tour

Manash Protim Borah
Roll No:16

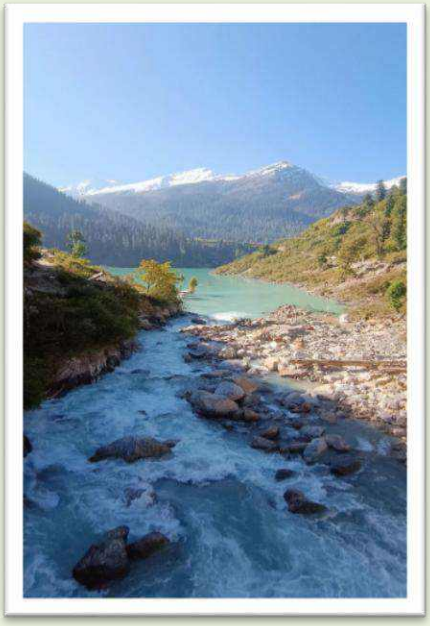
As part of our North India tour during training at the Telangana State Forest Academy, we undertook the Kheerganga trek in Himachal Pradesh. We are trainee Forest Range Officers, and the trek was planned as a same-day trek. The tour was accompanied by Krishna Prasad Sir, ACF, whose guidance and experience gave confidence throughout the journey. What we expected to be a physically demanding trek turned into a highly adventurous, educational, and memorable experience.

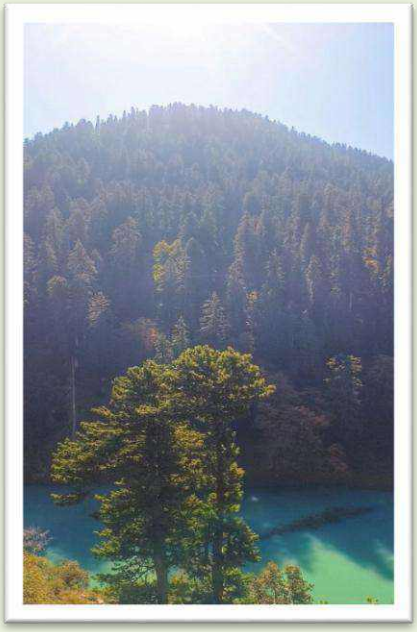
Journey to Barshaini and the Trek Begins

We started around 6:00 AM from Kasol. The early morning air was cold and fresh, and the Parvati Valley appeared calm and beautiful. The road from Kasol to Barshaini was narrow and winding, with sharp curves, broken patches, and steep drops on one side. In many places, the Parvati River flowed very close to the road. The river water was milky bluish-green in colour, fast-flowing and powerful, clearly showing glacial influence. Landslide-prone stretches and fragile road sections highlighted how sensitive mountain terrain is and how careful planning is required for infrastructure development.

After reaching Barshaini, we stopped and had hot maggi and omelette, which gave us the energy required for the long trek ahead.

The trek started near a scenic bridge at the starting point. Standing on the bridge, the view of the deep valley, flowing river, dense green forests, and surrounding mountains was breathtaking. This location itself showed the strong ecotourism potential of the area, where natural beauty attracts visitors without the need for heavy construction.





From there, the trail climbed steadily and passed through Nakthan village, where wooden houses and terraced fields reflected traditional mountain life. Along the trail, we came across apple trees, and with permission from locals, we plucked fresh apples. This showed how local communities depend on forests and nearby land for livelihood, highlighting the importance of balancing conservation with community needs.

As we moved ahead, the climb became long and physically exhausting. The trail was narrow, uneven, and rocky, with loose stones and exposed roots. Continuous uphill stretches tested stamina and breathing. In places where vegetation cover was thin, signs of soil erosion were clearly visible, while areas with good tree cover appeared more stable. This clearly showed the role of forests in slope protection and soil conservation.

Midway during the trek, we reached another bridge located in between the route. Near this bridge, a beautiful waterfall cascaded down the rocks. The sound of falling water, cool mist, and lush surroundings made it a refreshing spot. Such natural features enhance the trekking experience and also show how water availability supports forest health and biodiversity.

After walking further for some distance, we reached a small shop along the trail, where we stopped and had hot Maggi and lemon soda. This small shop reflected how ecotourism supports local livelihoods. Simple, low-impact facilities provide income to locals while keeping development minimal.

However, it also showed the need for proper waste management and visitor discipline to protect fragile ecosystems.

Beyond this point, the forest became denser, dominated mainly by pine trees, with a thick layer of dry needles on the forest floor. The climb felt endless, and fatigue slowly turned into mental exhaustion. This part of the trek highlighted the importance of physical fitness, patience, and mental control for working in difficult forest terrain.

After several hours of continuous trekking, we finally reached Kheerganga top. Cold winds were blowing, clouds moved rapidly across the sky, and snow-covered peaks were visible in the distance. We visited the natural hot water spring and the small Lord Shiva temple, but due to time constraints and the same-day return plan, we did not stay for long. The open meadow, clean air, and silence made it clear why this place attracts trekkers from across the country.

Return Journey and the Frightening Incident

The return journey was equally demanding. Legs were tired, knees ached, and very light rain fell for a short time, adding to the mountain atmosphere without making the trail slippery. As daylight started fading, we continued descending steadily and reached the bridge area at around 6:00 PM, which felt like a major milestone after a long day.

After this, the most frightening incident of the trek occurred. The road ahead was closed, and there was no clear walking path. We had to cross below the road, carefully moving across a steep and unstable slope. One wrong step could have been dangerous. Fear was clearly felt, and every step required full concentration. This situation showed how unexpected challenges can arise in mountainous regions and how calm thinking, discipline, and careful movement are essential for safety.

Conclusion

The Kheerganga trek was not just physically demanding but a strong learning experience combined with adventure. Scenic bridges, a powerful bluish-green river, waterfalls, steep climbs, visible soil erosion, community dependence on forest resources, simple ecotourism facilities, physical exhaustion, and a frightening crossing below the road made the journey intense and meaningful. The trek highlighted the need for responsible and regulated ecotourism, where natural beauty is preserved, local livelihoods are supported, and visitor safety is ensured. Completing the trek and returning the same day made it one of the most challenging, enriching, and memorable experiences of our North India tour and our training as trainee Forest Range Officers.

Lac: A Natural Resin Sustaining Forests and Livelihoods in the Bandhavgarh Corridor

Daisy Baishya
Roll No: 05

During the Central West India tour, we were exposed to the concept of lac and its wider significance for forest conservation and sustainable livelihoods. Through field visits and interpretive displays in the Bandhavgarh–Bandhav Corridor, we observed how lac, a natural resin produced by the tiny forest insect *Kerria lacca*, represents a unique link between ecological processes and rural economies. For centuries, lac has been an integral component of India's forest-based economy, particularly supporting tribal and forest-dependent communities. In landscapes such as the Bandhav Corridor, lac cultivation emerges as a sustainable alternative to destructive practices like indiscriminate tree cutting, especially of ecologically and economically valuable host species such as Kusum (*Schleichera oleosa*). The information boards encountered during the tour illustrated both the life cycle of the lac insect and the diversity of host plants, reinforcing lac's importance as a conservation-linked livelihood option in central and west India.

Lac insects can survive and reproduce only on specific host plants, and the field-based photographic displays highlighted the remarkable diversity of tree species capable of supporting lac cultivation. Lac encrustation, visible as resin deposits on branches, was shown on several forest and agroforestry species, demonstrating that lac production does not depend on monoculture systems. Important host plants include Kusum (*Schleichera oleosa*), which is regarded as the most productive and premium host, along with Palas (*Butea monosperma*), Ber (*Ziziphus* spp.), Pipal and Bargad (*Ficus* species), Gular, Rain tree, Tendu (*Diospyros melanoxylon*), Arhar, Sitaphal, Akashmoni, and Black Siris. This diversity of host species is particularly significant in mixed forest landscapes like the Bandhav Corridor, where lac cultivation can be integrated without altering natural forest structure or biodiversity.

The life cycle of the lac insect (*Kerria lacca*), begins with the emergence of tiny newborn insects known as crawlers from brood lac deposited on tree branches. These crawlers move to fresh, tender shoots of suitable host plants, where

they settle and insert their mouthparts to feed on plant sap. After settlement, the insects enter the nymphal stage, during which they secrete a resinous substance that forms a protective covering around their bodies. This secretion gradually thickens and eventually becomes the commercially valuable lac. As development continues, male and female insects differentiate; females remain fixed on the branches and continue resin secretion, while males develop within specialized cells. Winged male insects emerge briefly to fertilize the females and die soon after. Fertilized females continue secreting resin until the lac encrustation reaches maturity, at which point the resin-coated branches are ready for harvest. The entire life cycle typically spans six to eight months, depending on host species and climatic conditions.

Once harvested, raw lac is processed into a range of economically valuable products. These include shellac, which is widely used in wood polish, varnishes, food glazing, and pharmaceuticals; lac dye, a natural red colorant; electrical and insulation materials; cosmetics; and traditional handicrafts such as bangles, which are particularly important in central India. The biodegradable, non-toxic, and renewable nature of lac has increased its demand in both domestic and international markets, positioning it as an environmentally responsible alternative to synthetic materials.

Within the Bandhavgarh–Bandhav Corridor, forest-dependent communities have historically relied on timber extraction, fuelwood collection, and minor forest produce for survival. However, the cutting of Kusumi trees for short-term gains has resulted in the loss of premium lac host species, reduced long-term income opportunities, and degradation of forest structure. Such degradation also affects wildlife habitat and corridor connectivity, increasing the likelihood of human–wildlife conflict. In this context, lac cultivation offers a sustainable alternative by providing income from standing trees rather than felled ones. Regular lac harvests generate recurring income, encourage the protection of Kusum, Palas, and Ber trees, support biodiversity, and strengthen forest connectivity. Moreover, lac cultivation creates employment opportunities for tribal families, women, and youth, enhancing social inclusion and economic resilience in corridor landscapes.

Lac is more than a forest product; it is a bridge between ecology and economy. Observations from the Central West India tour and the interpretive materials in the Bandhav Corridor reveal a delicate natural process in which the life cycle of the lac insect depends on healthy trees and intact forests. By shifting the focus from cutting Kusumi trees to protecting them for lac cultivation, forest-dependent communities can secure sustainable livelihoods while contributing to forest conservation and wildlife corridor integrity. Promoting lac cultivation thus represents not only an economic opportunity but also a nature-based solution for conservation and community resilience in central India.

Fig. Resource person explaining about significance of lac in Bandhavgar corridor

Fig. Host plant for lac insect

Fig. Various products made of lac

Mist — Mangrove — Mishti

Khanjanjyoti Das
Rol No: 12

On 10th of January,2025 we went to Sundarban during our East India Tour programme. It the morning, through the winter Mist we witnessed the ineffable beauty of tangled roots, and fog-covered canopy of natural bridge between Humans and Sea-The Mangroves of Sundarban for the very first time.

The Sundarbans — the largest contiguous mangrove belt in the world's largest river delta (Ganga–Brahmaputra–Meghna) — is a globally important coastal forest that straddles India and Bangladesh. Formed from sediments deposited by the river system; alternating tides and riverine flows created the tidal islands and mudflats that allowed halophytic (salt-tolerant) plants to colonize and form mangrove forests over millennia. The landscape is a dynamic, accreting delta subject to storms, tides, erosion and sedimentation — processes that both build and threaten mangrove habitats. It is a UNESCO World Heritage site and a designated biosphere reserve because of its unique mangrove flora and fauna and its role in coastal protection and carbon storage. Protecting Sundarban mangroves is therefore both an ecological and a national priority for climate resilience, biodiversity conservation and livelihoods.

According to the Forest Survey of India's State of Forest Report 2023, India's total mangrove cover was about 4,992 km², of which West Bengal accounts for roughly 2,112 km² (≈42%), making the Sundarbans and adjacent coastlines a critical national mangrove repository.

Distribution (India & World)
India-Total mangrove area: 4992 sq km
East coast (Bay of Bengal): 56%
West coast (Arabian Sea): 31%
Bay Islands (Andaman & Nicobar): 12.5%

Mangroves are widespread on the east coast due to nutrient-rich alluvial soil formed by various rivers and perennial supply of fresh water along the deltaic coast.Deltas with alluvial deposits are almost absent on the west coast. Eastern coast has smooth, gradual slope and long coastline providing larger area for colonization by mangroves, whereas west coast has a steep and vertical slope.

World- Total mangrove cover: ~15 million ha (~1% of tropical forests of the world). Mangroves distributed in 123 countries between 24°N and 38°S. Asia has the largest extent of mangroves

Species, Vegetation types and Structure in the Sundarbans- Sundarbans harbour around 24 true mangrove species from multiple families — species adapted to tidal, saline conditions (e.g., Heritiera, Excoecaria, Ceriops, Sonneratia). Sonneratia is often an indicator of newly accreted mudflats, while Heritiera historically defined much of the Sundarban canopy.

These are the structural backbone of the mangrove forest.

Propagation-

Natural regeneration: Mangroves in the Sundarbans reproduce both sexually (seedlings / propagules) and vegetatively; Once pollination occurs, the seeds remain attached to the parent tree. They germinate into propagules before dropping into the waters below. This ability is referred to as “viviparity”. This type of germination is essential due to greater salt concentration in the mudflat with reducing oxygen conditions. Many species produce buoyant propagules that disperse with tides and water currents, allowing colonization of newly accreted banks (some take root in the sediments near the parent tree). Successful recruitment depends on suitable elevation, salinity, sediment deposition and protection from intense wave action.

Active restoration & planting: Restoration mixes site preparation (creating micro-topography or sediment traps), use of nursery-raised seedlings/ propagules of native species suited to local tidal regimes, and community stewardship models.

Importance- Coastal protection: Mangrove roots dissipate wave energy, reduce storm surge impacts and stabilize shorelines — services crucial for islands and low-lying settlements in the Sundarbans. They arrest coastal erosion and seawater pollution. Their protective role has been widely recognized, especially after the devastating Tsunami of 2004. The mangrove mosaic supports globally threatened fauna — including the unique population of the Bengal tiger adapted to mangrove habitat, estuarine crocodiles, river terrapins and numerous bird and fish species (Nursery for fisheries)— providing breeding, foraging and refuge habitats.

The backbone of coastal economy: Provides Livelihoods for the communities living on the fringes of the Sundarbans depending on the mangrove - linked resources: fishing, crab collection, honey, fuelwood, ecotourism and small-scale agriculture on protected lands. Healthy mangroves reduce disaster losses (avoiding income loss), sustain fisheries & food security. The fresh and moist bark of mangrove plants is a potential source of tannins, i.e., *Bruguiera cylindrica*, *Rhizophora mucronata*, etc. Commercial "keora water" is made from the distillation of Sonneratia apetala fruits. Mangroves are excellent feed for cattle. Used in traditional medicine, i.e., leaves of Avicennia officinalis are used to treat stomach and urinary disorders. Seeds of Heritiera littoralis are used in diarrhoea and dysentery. Bonphool is a honey gathered from the Sundarbans. Which are collected by the tribal cooperatives (Collectors wear a Face Masks on the Back of the Head to create Face Illusion & protecting themselves from Tiger Attack) and sell in the market under the brand name Bonphool.

Termite resistant timber

Adaptability and resilience of mangroves enable them to cope with moderate to high rates of sea-level rise. They are the Pure Source of oxygen. Mangroves

are high-value blue carbon ecosystems — their carbon storage capacity is 3 to 5 times higher than terrestrial forests. Therefore, helps in Climate change mitigation (SDG 13,14,15), adaptation and also helps in fulfilling the India's key INDC commitments. Habitat for thousands of species of birds, mammals and marine species. They act as a fertile breeding ground for many fish species and other marine fauna, i.e., mollusc, prawn, birds, reptiles, etc. Habitat for: Amur falcon, Olive ridley turtle, etc. Elevate soil profile and reduce salt concentration from the soil (by salt glands and other mechanisms).→ Agriculture becomes possible in the delta region. Purify water by absorbing pollutants, including harmful heavy metals.

Reclamation

Mangroves have the unique ability to help reclaim land from the sea as their complex root systems trap sediment, allowing new habitats to form. Urgency, threats and why faster action matters-There is a net decrease of 7.43 sq km in mangrove area compared with the 2021 ISFR assessment. Erosion, sea-level rise and cyclones: Accelerating sea-level rise, increasing cyclone intensity and human-induced changes (e.g., upstream flow regulation, reduced sediment supply, land conversion). Root clogging from increasing water turbidity, diseases, boring root animals, anthropogenic pressure. Between 1980 and 1990 alone, about 38% of the global mangrove area was degraded or lost through shrimp farming.

Nutrient deficiency Due to: Leaching of minerals with water percolation, high salinity makes many nutrients unavailable, anaerobic conditions that favor anaerobic bacteria growth who can convert nitrate into N-gases (denitrifying bacteria), Ferric (Fe^{3+}) to ferrous (Fe^{2+}) by iron-sulfur bacteria, and sulfate to its more toxic form (by de-sulpho-vibrio)

Biodiversity decline: Historical data show declines in key commercial mangrove species and wildlife pressures; reversing these declines needs immediate, sustained action across restoration, protection and sustainable resource use. Only in the last 50 years, we have lost about 40% of the global mangrove area, and if the current factor continues, they could become functionally extinct by 2100.

Major initiatives and policy responses (what's being done)

Forest Survey of India monitoring & reporting: Regular national forest reports (ISFR) track mangrove extent and condition, helping priorities and target-setting.

MISHTI (Mangrove Initiative for Shoreline Habitats and Tangible Incomes): A national/state-level push to expand mangrove restoration and link it with livelihoods (news reporting shows states like Gujarat are scaling up plantation under schemes named MISHTI/Mangrove Mission).

Protected area status & biosphere/World Heritage protections: Indian and Bangladesh protected-area frameworks, plus UNESCO recognition, give international and national legal and programmatic backing for Sundarban conservation.

What more can be done — practical, policy and community steps

1. Scale nature-based solutions with measurements: Systematically map and monitor blue carbon stocks in the Sundarbans, integrate verified blue-carbon credits and finance for large-scale restoration while ensuring benefit-sharing with local communities.

2. Sediment and freshwater management: Work across river basin (Ganga–Brahmaputra–Meghna) actors to safeguard sediment flows and manage upstream interventions that reduce sediment delivery — essential for natural island accretion and mangrove resilience.

3. Community co-management & alternative livelihoods: Expand community forest management, refine benefit-sharing (payments for ecosystem services, eco-enterprises), and provide cyclone-resilient livelihood alternatives to reduce pressure on mangrove resources.

(In Andhra Pradesh, Forest Department has formed Eco-Development Committees and Van Samrakshan Samithis under JFM to implement projects in mangrove areas.)

4. Species- and site-specific restoration protocols: Use local ecotype seedlings/propagules, choose species matching tidal elevation, and combine

soft-engineering techniques (sediment traps, siltation-enhancing structures) with planting to improve survival.

Plantation methods:

(a) Direct broadcasting of propagule

(b) Raised bed plantation

(c) Canal method or fish-bone channel plantation

5. Effective application of CRZ notification, forest acts & policies

Improve and strengthen forest department

Ensuring mangrove conservation and restoration are explicit, financed components of India's NDC implementation plans, and use national reporting (BUR/NDC updates) to mobilize climate finance for blue carbon.

6. Research, monitoring and early warning: Expand on-the-ground monitoring (biodiversity, carbon, shoreline change) and invest in community-linked early warning systems for cyclones and salinity intrusion. Promote forest certification measures to mangrove-derived products

Conclusion

The Sundarban mangroves are a living triple-win: biodiversity stronghold, frontline climate-adaptation infrastructure, and a provider of livelihoods for coastal communities. India's national forest reports and international designations underscore the region's priority status — but threats from climate change, hydrological alterations and socio-economic pressures make decisive, locally-sensitive action urgent. By combining rigorous monitoring (including blue carbon accounting), scientifically-informed restoration, upstream river-basin cooperation, strengthened policy integration with India's NDC/BUR processes, and community-centered livelihood strategies (including schemes such as MISHTI and other state programs), the Sundarbans can be conserved and restored as a resilient mangrove landscape for people and wildlife alike. The time to act — with science, policy and communities in step is now.

Narara Reef, Marine National Park (Jamnagar): A Living Classroom in Coastal and Marine Conservation

Oli Borah
Roll No. 24

As part of the West Central India Study Tour, the visit to Narara Reef, located within the Marine National Park, Jamnagar (Gujarat), emerged as one of the most memorable learning experiences during our training as Range Forest Officer trainees. While marine and mangrove ecosystems are often understood through textbooks, diagrams, and classroom instruction, Narara offered a rare opportunity to observe these ecosystems functioning as an integrated and dynamic system. We visited the park during low tide, when the sea slowly receded and exposed the intertidal zone. On one side stood dense mangroves with intricate root systems that stabilise the shoreline, while on the other lay exposed rocky and sandy zones supporting diverse marine fauna.

Mangrove Ecosystem and Species Diversity

Mangroves form the structural and functional backbone of Narara's coastal ecosystem. During the field visit, we observed six important mangrove species: *Avicennia marina*, *A. alba, A. officinalis, Rhizophora mucronata*, *Ceriops tagal*, and *Aegiceras corniculatum*. Each species exhibits specialised adaptations such as pneumatophores, prop roots, salt-excreting leaves, and viviparous germination, allowing survival in saline, waterlogged, and oxygen-deficient conditions.

The visit clearly demonstrated the intricate ecological linkages between mangroves and marine fauna. Mangrove leaf litter supports detritus-based food chains, while complex root systems provide shelter and breeding grounds for juvenile fish, prawns, and crabs. In turn, marine organisms contribute to nutrient recycling, sediment stability, and maintenance of water quality. These functional relationships emphasise that mangroves and associated marine ecosystems must be conserved and managed as an integrated unit.

Mangrove Restoration Techniques Observed

An important academic component of the visit was the study of mangrove restoration and afforestation practices implemented in the park. Particular emphasis was placed on the Otla bed technique, a scientifically proven method suitable for areas with strong tidal influence and soft muddy substrates. In this technique, raised mud platforms, locally known as Otlas, are constructed above normal tidal inundation levels. These beds reduce prolonged submergence, improve aeration around the root zone, prevent seedling washout, and significantly enhance survival rates of young mangrove plants. The technique is especially valuable in rehabilitating degraded coastal stretches.

Alongside this, the practice of direct seed sowing of *Rhizophora* species was explained in detail. Due to the viviparous nature of *Rhizophora*, elongated propagules are directly inserted into suitable intertidal mudflats without the need for nursery raising. This method closely mimics natural regeneration, is cost-effective, requires minimal infrastructure, and is particularly suitable for large-scale mangrove restoration programmes. Observing these techniques in the field provided valuable insight into applied coastal forestry and ecosystem-based restoration.

Fig. Intertidal field visit

Fig. Mangrove habitat assessment

Fig. Mangrove plantation

Marine Faunal Diversity of the Intertidal Zone

The low-tide exploration revealed a remarkable diversity of marine fauna, each occupying a specific ecological niche within the intertidal zone. Tiger prawns and shrimps were commonly observed along mangrove margins and shallow pools. These crustaceans play a vital role in the food web and are also of economic importance, linking ecosystem health with coastal livelihoods. Barnacles were found firmly attached to rocks, forming dense clusters. As filter feeders, they indicate well-oxygenated and relatively unpolluted waters. A wide range of crabs was seen, including sand crab, box crab, coral crab, Neptune crab, and monkey crab, each occupying specific microhabitats and playing a role in nutrient cycling and sediment turnover. Pinna oysters were observed standing vertically embedded in the substrate. These large bivalves function as natural biofilters, improving water clarity and serving as indicators of healthy marine conditions. Collectively, these species play a crucial role in sediment turnover, detritus processing, and energy flow within the ecosystem.

Fig. Neptune crab

Fig. Pinna oyster

Fig. Hermit crab

Unique and Ecologically Significant Species

Several species observed during the visit were of particular academic interest due to their unique adaptations. Sea anemones were commonly found in shallow tidal pools, their soft and colourful tentacles gently swaying with water movement. Despite their plant-like appearance, they are carnivorous animals and play important roles in reef ecosystems through symbiotic relationships. Sea cucumbers were observed slowly moving across sandy and muddy substrates, ingesting sediment and recycling organic matter. By maintaining sediment quality, they act as natural cleaners of the sea floor and are key indicators of a balanced benthic ecosystem. One of the most memorable sightings was that of an octopus, perfectly camouflaged among rocks. Live sponges of various colours and textures were observed attached to rocky substrates. These organisms continuously filter seawater, contributing to water purification while providing microhabitats for smaller marine organisms.

Fig. Sea cucumber

Fig. Octopus

Fig. Sea anemone

Fig. Marine sponge

Learning beyond Textbooks

The visit to Narara Reef truly bridged the gap between theory and practice. Concepts like mangrove ecology, intertidal zonation, and marine species interactions became clear through direct observation. Walking through mangroves, witnessing coral-associated fauna, and understanding conservation techniques in the field made this experience invaluable.

For us, as Range Forest Officer trainees, this visit strengthened our understanding of marine and coastal conservation and highlighted the importance of protecting fragile ecosystems like mangroves and coral reefs. Narara Reef was not just a field visit; it was a living classroom that left a lasting impact on our professional journey in forest and wildlife management

Rejuvenation of Pillalamarri Banyan Tree: Heritage Tree Conservation

Moitree Gogoi
Roll no.17

Pillalamarri Park in Mahabubnagar, Telangana, is home to the iconic Pillalamarri banyan tree (Ficus benghalensis), believed to be over seven centuries old (700 years). Once spreading majestically over several acres, the tree is not only a natural wonder but also a cultural and historical landmark. However, years of neglect, environmental stress, and biological infestation pushed this living heritage to the brink of collapse, prompting one of India's most notable tree rejuvenation efforts.

Decline of the Banyan

By 2017–2018, large portions of the banyan showed severe distress. The primary causes included termite and fungal infestations weakening the internal wood, soil compaction and root stress due to heavy tourist footfall, structural imbalance with massive horizontal branches unable to support their own weight.

Eventually, the fall of a major limb led authorities to close the park to the public, marking a turning point in the tree's management.

The 5 Steps of Rejuvenation Process

1. **Termite Eradication via Drip Irrigation:** Infected areas were treated by injecting diluted insecticides directly into the trunk and branches using a saline drip-like method, and watering roots with the solution to kill termites.

2. **Physical Support for Heavy Branches:** Large cement pillars and temporary structures were built to support collapsing, heavy branches and prop roots that couldn't bear their own weight.
3. **Nutrient & Moisture Enrichment:** Pipes filled with rich soil, coco peat, and vermicompost were installed for roots, while organic fertilizers like Panchagavya (cow dung, urine, curd, ghee mix) were sprayed to boost immunity and provide nutrients.
4. **Root Stimulation & Growth:** Trenches were dug to help roots penetrate the soil, and pipes (52+ installed) with soil/manure aided hanging roots, encouraging them to grow and provide more support.

5. **Sustainable & Ongoing Care:** The treatment transitioned to bio-pesticides, fertilizers, and regular watering (even using tankers in dry periods) to ensure long-term health, moving from chemical to more organic, sustainable methods.

Results and Current Status

The sustained intervention stabilized the tree and revived significant portions of its canopy. New leaf growth and strengthened aerial roots indicated recovery. The Park infrastructure was redesigned with protective fencing, regulated access, and surveillance, emphasizing conservation over recreation. Pillalamarri now stands as a symbol of how science-based intervention can save even the most ancient living organisms when timely action is taken.

The road ahead

While rejuvenation has yielded positive results, long-term survival requires a proactive and holistic strategy:

1. Permanent Heritage Tree Management Plan: To declare the tree a living heritage monument with a dedicated annual conservation budget. Assign trained arborists rather than general maintenance staff.

2. Continuous Monitoring and Research: Use soil sensors, pest monitoring, and periodic health audits. Collaborate with universities and botanical research institutions for long-term studies.
3. Eco-Sensitive Tourism: Restrict visitor movement near the root zone permanently. Develop elevated walkways and interpretation centers to educate visitors without harming the tree
4. Community and Educational Involvement: Involve local communities, schools, and NGOs in awareness programs. Promote Pillalamarri as a case study in environmental education and urban forestry.
5. Replication of Best Practices: Document and standardize the rejuvenation techniques used. Apply lessons learned to protect other ancient and heritage trees across India.

The rejuvenation of the Pillalamarri banyan tree demonstrates that ancient trees, despite severe decline, can be revived through a blend of scientific innovation, traditional knowledge, and sustained commitment. With a forward-looking conservation approach, Pillalamarri can continue to thrive—not just as a tourist attraction, but as a living testament to ecological resilience and responsible stewardship.

Sakrebyle and M.R. Palayam Elephant Camps: An Insight into Elephant Management and Conservation

Jyotiprasanta Sarma
Roll No: 09

Elephant camps play a crucial role in the conservation, care, and management of captive elephants in India. A visit to Sakrebyle Elephant Camp in Karnataka and M.R. Palayam Elephant Camp in Tamil Nadu provides valuable insight into traditional elephant husbandry practices blended with modern wildlife management principles. Both camps function as important centers for elephant care, training, and human–elephant coexistence.

Sakrebyle Elephant Camp

Sakrebyle Elephant Camp is located near Shimoga, on the banks of the River Tunga, and functions under the Karnataka Forest Department. The camp is well known for its systematic approach to elephant management and public awareness programs.

Management and Daily Routine

The day at Sakrebyle begins early in the morning with the bathing of elephants in the river. Bathing serves multiple purposes: maintaining hygiene, cooling the animals, and strengthening the bond between elephants and their mahouts (caretakers). Each elephant is assigned a mahout and, in many cases, a kawadi (assistant), ensuring personalized care.

Following bathing, elephants are fed a carefully planned diet that includes ragi balls, rice, green fodder, sugarcane, and seasonal fruits. The diet is designed to meet nutritional requirements while considering the elephant's age, workload, and health condition. Regular health checkups are conducted by veterinary officers to monitor physical condition, foot health, and signs of stress or disease.

Training and Welfare

Training at Sakrebyle is humane and gradual, focusing on voice commands and positive reinforcement rather than force. Young elephants, especially those rescued or born in captivity, undergo basic training to help them adapt to human presence. Emphasis is placed on minimizing stress and maintaining natural behavior as much as possible. Crawl area is used to tame the elephants.

The camp also plays an educational role by allowing controlled visitor interactions, helping spread awareness about elephant conservation and the importance of ethical wildlife tourism.

M.R. Palayam Elephant Camp

M.R. Palayam Elephant Camp, located near forest regions of Tamil Nadu, primarily supports forest operations and elephant conservation initiatives. It is less tourist-oriented compared to Sakrebyle and focuses more on operational and rehabilitation activities.

Care and Management Practices

Elephants at M.R. Palayam are involved in forest patrolling, rescue operations, and conflict mitigation in nearby villages. The management follows a disciplined routine that balances work and rest. Elephants are allowed to forage naturally in forest areas for several hours daily, promoting physical fitness and psychological well-being.

The feeding schedule includes natural fodder supplemented with cooked food prepared under the supervision of forest staff. Special care is taken during summer months to prevent dehydration and heat stress.

Veterinary and Ethical Management

Veterinary care is a critical component of management at M.R. Palayam. Periodic medical examinations, deworming, and foot care are strictly followed. Older and retired elephants are given lighter duties or complete rest, reflecting a welfare-oriented approach.

Mahouts are trained not only in elephant handling but also in understanding elephant behavior, stress indicators, and emergency response. This professional training significantly reduces the risk of accidents and enhances animal welfare.

Comparative Observations

While both camps follow similar core principles of elephant management, Sakrebyle places greater emphasis on public education and tourism, whereas M.R. Palayam focuses more on operational forest management and rehabilitation. Both camps demonstrate the importance of structured routines, dedicated caretakers, and veterinary support in maintaining the health and dignity of captive elephants.

The visit to Sakrebyle and M.R. Palayam Elephant Camps highlights the complexity and responsibility involved in elephant management. These camps serve as models for ethical wildlife care, combining traditional knowledge with modern conservation practices. Proper management, respect for animal welfare, and continuous training of staff are essential to ensuring that elephants live healthy, secure, and dignified lives in captivity. Such camps also play a vital role in promoting awareness and fostering coexistence between humans and elephants.

Shola Forests: The Silent Guardians of the Western Ghats

Moitree Gogoi
Roll No: 17

High in the mist-covered mountains of the Western Ghats lies one of India's most delicate and least understood ecosystems—the shola forests. Often overlooked in favour of dense tropical rainforests, sholas quietly sustain rivers, shelter rare wildlife, and regulate the climate of southern India. Today, as climate change and human pressures mount, these ancient ecosystems are at a critical crossroads.

A Landscape Like No Other

Shola forests are not continuous stretches of woodland. Instead, they form a striking patchwork of evergreen forest pockets nestled in valleys, surrounded by rolling montane grasslands on hilltops and slopes. This mosaic occurs at elevations above 1,500 metres, where cool temperatures, heavy rainfall, and persistent mist shape a world very different from the tropical lowlands below.

Found mainly in the Nilgiri, Anamalai, and Palani hills, shola landscapes are protected in places such as Mukurthi, Eravikulam, and Silent Valley National Parks. These regions are part of the globally recognized Western Ghats World Heritage Site.

Forests That Capture Water

One of the most remarkable roles of shola forests is their ability to store and release water. Thick layers of leaf litter and rich humus act like a sponge, absorbing rainfall and slowly releasing it into streams and rivers. Many of south India's important rivers—including the Bhavani and Periyar—originate in shola landscapes. In an

era of increasing droughts and erratic monsoons, sholas function as natural water towers, ensuring perennial water flow for agriculture, drinking, and hydropower downstream. The endemic species like *Michelia nilagirica*, *Litsea wightiana*, *Syzygium spp.*, and *Rhododendron arboretum* are found here.

A Haven of Hidden Life

Despite their small extent, shola forests are biodiversity hotspots. Their cool, stable climate has allowed ancient species to evolve in isolation, leading to exceptional levels of endemism. The surrounding grasslands are home to the Nilgiri Tahr, an endangered mountain goat found nowhere else in the world. Shola forests shelter elusive mammals like the Nilgiri marten, along with brilliantly coloured endemic birds such as the Nilgiri flycatcher and black-and-orange flycatcher. Amphibians, many of them extremely sensitive to environmental change, thrive in the moist forest floor.

Fragile and Fire-Sensitive

Shola ecosystems are not resilient to disturbance. Unlike many tropical forests, shola trees are poorly adapted to fire. Even low-intensity fires along forest edges can kill saplings and permanently alter forest structure. Repeated fires allow grasslands to expand at the expense of shola forests, slowly unravelling the ecosystem.

Adding to the challenge is the spread of invasive alien species. Trees such as wattle, eucalyptus, and pine, introduced during the colonial period, have

aggressively invaded grasslands and forest margins. These species consume large amounts of water, suppress native vegetation, and fragment habitats.

Climate Change at the Rooftop

Climate change poses perhaps the greatest long-term threat. Rising temperatures and shifting rainfall patterns are already affecting high-altitude ecosystems. With little room to move upward, many shola species face the risk of habitat loss and extinction.

Caring for a Living Mosaic

Conserving shola forests requires a carefully balanced approach. Protection alone is not enough; active management is essential. Forest departments now focus on: Strict fire prevention, including fire lines and early-warning systems, gradual removal of invasive species, followed by restoration of native grasses and shola trees, assisted natural regeneration, allowing forests to recover without heavy planting, regulated tourism, ensuring minimal disturbance to sensitive habitats. Local communities play a growing role in fire prevention and conservation awareness, recognizing that protecting sholas also protects water security and livelihoods downstream.

The Road Ahead

Shola forests may cover only a small fraction of the Western Ghats, but their importance far outweighs their size. They regulate water, stabilize climate, and preserve a living archive of evolutionary history. Protecting them requires long-term vision, scientific management, and public support. As climate uncertainty grows, the survival of these misty forests may determine the ecological future of southern India.

Case Study: Mukurthi National Park — Saving the Shola–Grassland Mosaic

Perched high on the Nilgiri plateau, where clouds drift low and the air carries a persistent chill, Mukurthi National Park stands as one of India's quietest yet most significant conservation successes. Often overshadowed by larger tiger reserves, Mukurthi protects something far rarer — the shola–grassland ecosystem, a landscape as fragile as it is ancient.

A Park Born Out of Necessity

Mukurthi was declared a National Park in 1990, not for charismatic big cats, but to protect the rapidly declining Nilgiri Tahr, an endangered mountain ungulate found only in the Western Ghats. Spanning just 78.5 square kilometres, the park lies between 1,500 and 2,600 metres above sea level, making it one of the highest protected areas in southern India.

But conserving the Nilgiri Tahr meant protecting its home — the open montane grasslands interwoven with dense shola forest patches.

The Shola–Grassland Balance

What makes Mukurthi special is its near-pristine shola–grassland mosaic. Shola forests occupy sheltered valleys, while grasslands dominate ridges and slopes. This balance is crucial: Grasslands provide grazing for Nilgiri Tahr, Shola forests regulate water and stabilize soil, together they support endemic plants, birds, and amphibians**.** Disrupt one, and the entire system begins to unravel.

A Landscape Under Pressure

Despite its remoteness, Mukurthi has not been immune to human impact. During the colonial period, large areas around the park were planted with wattle (Acacia mearnsii), eucalyptus, and pine. Over time, wattle aggressively spread into native grasslands, reducing habitat for the Nilgiri Tahr and altering hydrology. Fire posed another major threat. While grasslands can tolerate occasional natural fires, shola forests cannot. Repeated human-induced fires along forest edges caused gradual degradation of shola patches.

Turning the Tide

Management Interventions: Mukurthi's conservation story is defined by careful, science-led management rather than heavy-handed intervention.

- **Fire Management**: Strict fire prevention measures, fire lines and watchtowers, rapid response during dry seasons, community coordination in surrounding areas. The emphasis shifted from firefighting to fire prevention.
- **Invasive Species:** *Control* Wattle removal was undertaken gradually, not abruptly. Mechanical removal of mature trees, prevention of re-sprouting, restoration of native grasses and shola species. This phased approach prevented soil erosion and allowed native vegetation to recover naturally.

- **Nilgiri Tahr Conservation***:* Mukurthi today supports one of the largest and most stable populations of Nilgiri Tahr in India. Open grasslands are actively maintained, while disturbance is kept minimal.The project Nilgiri Tahar has been also introduced.
- **Regulated Tourism:** Tourism in Mukurthi is strictly controlled by the following ways-Entry only with permission, limited trekking routes, no mass tourism infrastructure. This low-impact model prioritizes ecosystem health over

Water Security Beyond the Park

Mukurthi's importance extends far beyond its boundaries. The Park protects the headwaters of the Bhavani River, a lifeline for agriculture, drinking water, and hydropower in Tamil Nadu. By conserving shola forests, Mukurthi indirectly supports thousands of livelihoods downstream.

Lessons That I Learned From Mukurthi

Mukurthi National Park offers powerful lessons for conserva tion across India

- Grasslands are ecosystems, not wastelands Small protected areas can have huge ecological value
- Invasive species removal must be scientific and patient
- Fire prevention is critical in montane systems
- Conservation works best when disturbance is minimized.

A Model for the Future

In an age of climate uncertainty, Mukurthi acts as a climate refuge for high-altitude species with nowhere else to go. Its success shows that protecting fragile ecosystems requires restraint, long-term commitment, and respect for ecological processes. "*Mukurthi reminds us that conservation is not always about saving what is loud and visible — sometimes it is about quietly protecting what sustains everything*"

Sundarban Tiger Reserve- A Comprehensive Study of Man Animal Conflict and Mitigation Measures

Priyanka Hatimata
Roll No: 26

The Sundarban tiger reserve is one of the most unique and ecologically significant protected areas in the world, located in southern part of West Bengal, and total population of tiger is 180 at present. It is famous for mangrove ecosystem and significant tiger habitat, where people and wildlife live in very close proximity and it is also a UNESCO World Heritage Site. Sundarban Tiger Reserve plays a crucial role in coastal protection, acting as a natural barrier against cyclones, storm surges, and soil erosion. Conservation here focuses not only on wildlife protection but also on man-animal conflict management and sustainable coexistence between human and nature. Due to dependency on forest resources (like honey, fishing, wood), local communities frequently come into contact with tigers and occasionally estuarine crocodiles which leads to serious human–animal conflict. Human–tiger conflicts include tigers straying into villages, attacks on people and livestock, and subsequent retaliatory killing, historically causing many deaths on both sides.

Unique Conflict Mitigation Measures

- Nylon Net Fencing

Nylon-net and polypropylene fencing are installed along sensitive forest village interfaces to prevent tigers from straying into settlements. For tiger straying, the forest department established 108km nylon net fence which results a remarkable decline of human animal conflict. It is non-lethal, eco-friendly conflict mitigation also acts as a psychological and physical barrier to prevent tiger entry into human settlements. Tiger perceives the net as a visual obstruction and avoid crossing it, causes no injury to wildlife, unlike electric or braved fencing. WWF-India and the Forest Department have restored damaged net fences after cyclones to reduce negative encounters between people and tigers.

- Tiger Response and Rapid Response Teams

Rapid Response Team works as a quick- action force to manage human-wildlife conflict, not limited to tigers alone. Primary or village tiger response teams are trained to respond quickly to conflict situations, including safely driving tigers back into the forest. These teams support forest staff during human-tiger conflict events and handle wildlife emergency situations.

- Community Awareness & Education

Awareness campaigns, Sundarban Education Centres, and community engagement help build positive attitudes toward tiger conservation and reduce risky forest practices. Eco-development and outreach programs inform communities about safe behaviours and conflict avoidance.

- Alternative Livelihoods and Resource Use

Projects like the Sundarbans Project (implemented with IUCN, KfW, local NGOs) aim to reduce dependence on forest extraction by promoting sustainable alternatives and skill training (e.g. sustainable resource collection, improved cook stoves to reduce fuelwood use).

- Monitoring and Research

Ongoing monitoring of tiger populations, conflict hotspots, and the dynamics of human–wildlife interactions help shape mitigation strategies.

Man–animal conflict in the Sundarban Tiger Reserve is a complex issue arising from the fragile mangrove ecosystem, high human density, and overlapping use of forest and river resources by both people and wildlife,

particularly the Royal Bengal tiger. Over the years, the Forest Department and allied agencies have adopted a multi-pronged mitigation strategy, combining physical barriers, rapid response mechanisms, community participation, and awareness programmes. Measures such as nylon net fencing, Tiger Response Teams (TRT), Rapid Response Teams (RRT), early warning systems, and regulated forest access have significantly reduced incidents of tiger straying and retaliatory killings.

Equally important is the active involvement of local communities through Eco-Development Committees (EDCs), alternative livelihood options, compensation schemes, and continuous sensitization. These initiatives have strengthened trust between villagers and the forest department, promoting coexistence rather than conflict. Man–animal conflict mitigation in the Sundarban is not a one-time intervention but a continuous adaptive process. Long-term success depends on: unstained community co-operation, Scientific monitoring of wildlife movement, strengthening response, infrastructure, Climate-resilient planning to address sea-level rise and habitat change. A balanced approach integrating conservation with human welfare remains the cornerstone for ensuring both tiger survival and safe livelihoods in the unique and dynamic Sundarban landscape.

Therikaadu: Tamil Nadu's Red Desert — A Crimson Wonder of the South

Moitree Gogoi
Roll No: 17

Nestled in the southern reaches of India, in the coastal plains of Thoothukudi and Tirunelveli districts in Tamil Nadu, lies a landscape that seems transported from another world — Theri Kaadu, commonly known as the Thirikaadu Red Desert. Unlike the expansive arid wastes of the Thar in Rajasthan, this desert isn't formed by classical aridity alone; it's a unique geological and ecological marvel shaped by ancient seas, winds, and time itself.

A Landscape Painted in Red

Therikaadu's most striking feature — its deep red sands — owes its color to iron oxide-rich sediments. These sediments were weathered inland and transported by rivers to what were once ancient coastal regions. Over tens of thousands of years, strong seasonal winds sculpted these sands into the shifting dunes that grace the landscape today.

The Tamil words "Theri" (meaning sand dune) and "Kaadu" (forest) tell a story of contrast: a desert-like expanse interspersed with patches of hardy vegetation — a red "forest" shaped by nature's winds and patience.

Geological Origins: Echoes of Ancient Seas

Theri Kaadu is more than just a patch of sand — it's a living geological record. Scientists suggest that this region was once submerged under ancient seas. As sea levels rose and fell during the Quaternary Period, sediments deposited on former beaches became exposed. Winds then carried these iron-rich grains, forming dunes that now stretch across thousands of acres near the Gulf of Mannar coast.

Unlike classical deserts shaped solely by rainfall deficits, Theri Kaadu's existence stems from its coastal heritage — it's a rare coastal dune desert in peninsular India, made unique by its formation processes.

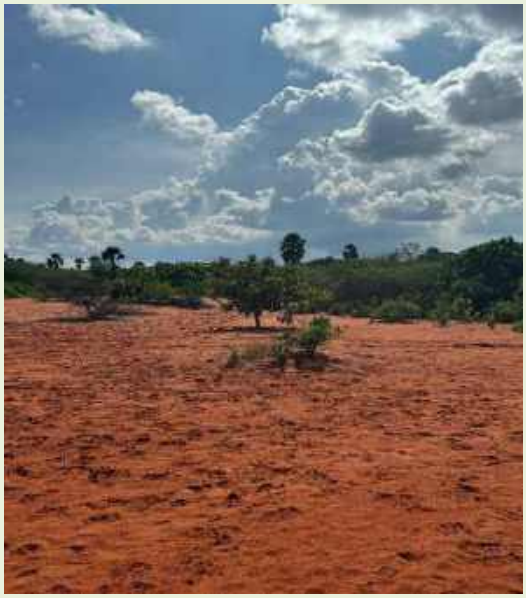
Types of Dunes: A Moving Canvas

Geologists classify the landscape into three dune types based on their distance from the sea:

- Inland Theris — more stable, farther from coastal influences.
- Near-Coastal Theris— moderately dynamic.
- Coastal Theris — continuously reshaped by strong winds.

These constantly shifting dunes create an ever-evolving topography that mesmerizes visitors and geologists alike.

Flora and Fauna: Life in the Sands



Contrary to the notion of barren deserts, Theri Kaadu supports a surprising range of adapted life. The sandy, porous soils retain little water, conditions that few plants can tolerate. Yet vegetation such as Palmyra palms, hardy shrubs like *Prosopis juliflora*, *Anacardium occidentale* trees, and native grasses persist, binding the sands and helping to slow their movement. Wildlife here includes species that have adapted to the harsh sandy habitat — fan-throated lizards, spotted owlets, kestrels, snakes like saw-scaled vipers, and a variety of insects and butterflies all make this landscape their home.

These ecological pockets offer micro-habitats that contrast vividly with the seemingly stark desert backdrop.

Human Interaction: Culture, Challenges, and Conservation

Local communities have historically made their living around Therikaadu by utilising hardy plants like palms and cashews that can withstand drought conditions. The dunes also host temples such as Arunchunai Kaatha Ayyanar, adding a spiritual dimension to the stark landscape.

However, the area faces environmental pressures: unregulated sand and mineral mining, invasive species like Prosopis, and anthropogenic changes threaten the delicate balance of this ecosystem. Conservation and sustainable tourism are increasingly seen as vital to preserving Theri Kaadu's fragile beauty.

My Personal Experience in the Red Desert of Tamil Nadu

My visit to the red desert of Tamil Nadu was a unique and unforgettable experience. As I stepped onto the vast land, the first thing that caught my attention was the deep red color of the soil. It stretched endlessly under the bright sun, giving the place a mysterious and beautiful appearance.

Walking through the desert, I noticed how silent the surroundings were. Unlike busy cities, this place had a calmness that allowed me to connect with nature. Even though the land looked dry and harsh, I was amazed to see small plants and hardy trees surviving there. It taught me how strong and adaptable nature could be.

This experience helped me appreciate nature more and understand the importance of protecting such unique environments. The red desert of Tamil Nadu will always remain a special memory for me.

Why Thirikaadu Matters

Therikaadu is not just a scenic oddity; it is a natural laboratory, a testament to Earth's dynamic climatic history, and an ecological mosaic worth protecting. Its red dunes whisper stories of ancient shorelines, changing seas, and aeolian forces that have sculpted one of South India's most fascinating landscapes.

Wolf Breeding Centre at Bajana, Gujarat

Surushree Patowary
Roll No.: 35

Our visit to the Wolf Breeding Centre at Bajana, Gujarat, formed an integral part of the West-Central India Tour, undertaken under the Bharat Darshan programme during the 18-month training of Forest Range Officer (FRO) trainees at the Telangana State Forest Academy (TSFA), Dulapally, Hyderabad. Bharat Darshan, as envisioned in our training curriculum, is not merely a geographic traversal of the country but a pedagogical journey - one of a type that allows us to witness India's ecological diversity, management challenges, and conservation philosophies first-hand. Located on the fringes of the Little Rann of Kutch, the breeding centre is embedded in a stark semi-arid landscape where grasslands, saline plains, and scattered scrub dominate the horizon. This setting itself served as an early lesson: wildlife conservation in India is not limited to dense forests or mountainous terrains. Species like the Indian Grey Wolf (*Canis lupus pallipes*) thrive in open landscapes that are often undervalued, misclassified, or overlooked in mainstream conservation narratives.

Conservation Significance of the Indian Grey Wolf and the Bajana Facility

The Indian Grey Wolf is among the most ancient and evolutionarily distinct wolf lineages, adapted over millennia to survive in India's arid and semi-arid ecosystems. Unlike its counterparts in colder regions, this subspecies is leaner, more heat-tolerant, and highly mobile. Yet, despite its ecological

resilience and legal status as a Schedule I species under the Wildlife (Protection) Act, 1972, the Indian Grey Wolf remains one of the country's most misunderstood and persecuted carnivores. Its range largely overlaps with human-dominated landscapes, pastoral settlements, and agricultural fields, making conflict inevitable in the absence of informed management. The Wolf Breeding Centre at Bajana thus assumes special importance. It is not only a site for ex-situ conservation, but also a space for research, documentation, and sensitisation-providing insights into a species that rarely receives focused attention compared to larger carnivores. For us as trainees, the centre underscored the reality that conserving species like the wolf demands a blend of science, empathy, and social understanding, rather than protectionist measures alone.

Infrastructure, Scientific Management and Monitoring Protocols

The physical design and operational philosophy of the centre reflect a deep awareness of wolf behaviour. The enclosures are expansive and structured to mimic natural conditions, incorporating earthen substrates, vegetation, and visual barriers that allow the animals to retreat from constant visibility. Unlike zoological displays, the emphasis here is on privacy, minimal disturbance, and behavioural normalcy.

Modern non-intrusive monitoring systems such as CCTV surveillance are employed to observe social interactions, breeding behaviour, and health indicators without direct human presence. Feeding schedules, veterinary interventions, and enclosure maintenance follow strict standard operating procedures, ensuring that human interaction is purposeful and

limited. Equally important is the focus on genetic management. Breeding decisions are guided by long-term objectives rather than short-term outcomes, with careful attention to lineage, pair compatibility, and avoidance of inbreeding. This approach reflects internationally accepted best practices for canid conservation and reinforces the importance of patience and restraint in wildlife management.

Social Organisation, Selective Breeding and Cooperative Reproduction

One of the most intellectually enriching components of our visit was the detailed explanation of wolf social ecology. Wolves are not solitary predators but function within highly organised family units, commonly referred to as packs. Each pack is typically led by a dominant breeding pair, often described as the alpha male and alpha female, who share a strong social bond. Breeding within the pack is usually restricted to this pair. Rather than being enforced through constant aggression, this selective breeding is maintained through social hierarchy, behavioural cues, and hormonal mechanisms that suppress reproduction in subordinate individuals. Such a system ensures pack stability and allows focused investment in pup survival. Of particular interest was the discussion on pseudo-pregnancy (pseudocyesis) observed in subordinate female wolves. Despite not mating, these females undergo hormonal changes similar to pregnancy and may even lactate. This biological phenomenon enables them to assist the alpha female in nursing and caring for pups, effectively functioning as alloparents. This cooperative reproductive strategy is a powerful evolutionary adaptation. It enhances pup survival, strengthens pack cohesion, and exemplifies the collective nature of wolf society. Learning about this phenomenon in the field made it evident why disruption of pack structure - through habitat loss, persecution, or removal of individuals - can severely affect wolf populations.

Field Observations and Reflective Learning as an FRO Trainee

The visit to Bajana was as much a lesson in self-reflection as it was in wildlife biology. Observing the wolves - alert, cautious, and deeply social - prompted us to reconsider long-held societal narratives that portray them as ruthless predators. Instead, we encountered a species governed by cooperation, restraint, and familial bonds. Interacting with field staff further revealed the

practical challenges of wolf conservation, particularly in landscapes where livestock rearing is integral to local livelihoods. The discussions highlighted the importance of community engagement, compensation mechanisms, and awareness programmes in reducing conflict. As trainees preparing to assume responsibilities in the field, this experience reinforced the understanding that effective forest governance requires listening as much as enforcing, and knowledge as much as authority.

Conclusion and Way Forward

The Wolf Breeding Centre at Bajana stands as a quiet yet profound conservation initiative, addressing the needs of a species that exists at the intersection of ecology and society. Its success lies not in visibility, but in its commitment to scientific rigour, behavioural understanding, and ethical restraint.

Looking ahead, stronger linkages between ex-situ research and in-situ conservation, coupled with sustained community outreach, will be essential for securing the future of the Indian Grey Wolf. Grasslands and semi-arid ecosystems must also receive the recognition they deserve within India's conservation framework. For us, as part of the Bharat Darshan programme, this visit left a lasting imprint. It reminded us that conservation is not always dramatic or visible -often, it unfolds quietly, guided by patience, respect for

nature, and informed stewardship. These lessons will remain central to our journey as future forest officers. Looking ahead, stronger linkages between ex-situ research and in-situ conservation, coupled with sustained community outreach, will be essential for securing the future of the Indian Grey Wolf. Grasslands and semi-arid ecosystems must also receive the recognition they deserve within India's conservation framework. For us, as part of the Bharat Darshan programme, this visit left a lasting imprint. It reminded us that conservation is not always dramatic or visible -often, it unfolds quietly, guided by patience, respect for nature, and informed stewardship.

These lessons will remain central to our journey as future forest officers.

Bharat Darshan: A Forest Range Officer Trainee's Journey Across India

Suvushree Patowary
Roll No: 35

Training as a Forest Range Officer is shaped as much by lived experience as by classroom lessons. While classrooms provide frameworks and manuals outline procedures, it is the forest itself that imparts the most enduring lessons. Our journey-from an introductory tour to an expansive Bharat Darshan-was one such formative passage, transforming our understanding of forestry from an academic pursuit into a lived responsibility.

Introductory Tour: Amrabad Tiger Reserve (July 2024)

Our first field exposure was in July 2024 at Amrabad Tiger Reserve, Telangana. The reserve's rugged terrain, dry deciduous forests, and ancient valleys became our first classroom. Here, we learnt the *taur-tarike* or the ways of the jungle-how to walk with awareness, observe silently, and understand the forest beyond maps and textbooks. As we camped inside the reserve, heavy rains lashed the landscape. Nights were cold, the ground damp, and rest came sparingly. The continuous rain tested both our physical endurance and mental resolve. What was meant to be an introductory experience quickly turned challenging, reminding us that forestry seldom offers comfort or predictability.

Exposure to patrolling routines, fire protection measures, and habitat management works grounded theory in reality. The sessions on Botanization and snakes were refreshing. The Trek to saleshwaram & Akkamahadevi caves tested our endurance firsthand. Most importantly, Amrabad instilled discipline and humility. It taught us that a forester's authority is rooted not in command, but in understanding the land and respecting those who protect it daily. Amrabad taught us our earliest and perhaps most enduring lesson: that a forester's duty begins long before convenience, and that resilience is as essential as knowledge.

Telangana-Maharashtra State Tour (August 2024)

The Telangana-Maharashtra State Tour in August 2024 broadened our exposure to protected area management across state boundaries. Visits to Pench Tiger Reserve, Tadoba-Andhari Tiger Reserve, and Tipeshwar Wildlife Sanctuary revealed varied approaches to conservation within similar ecological settings.

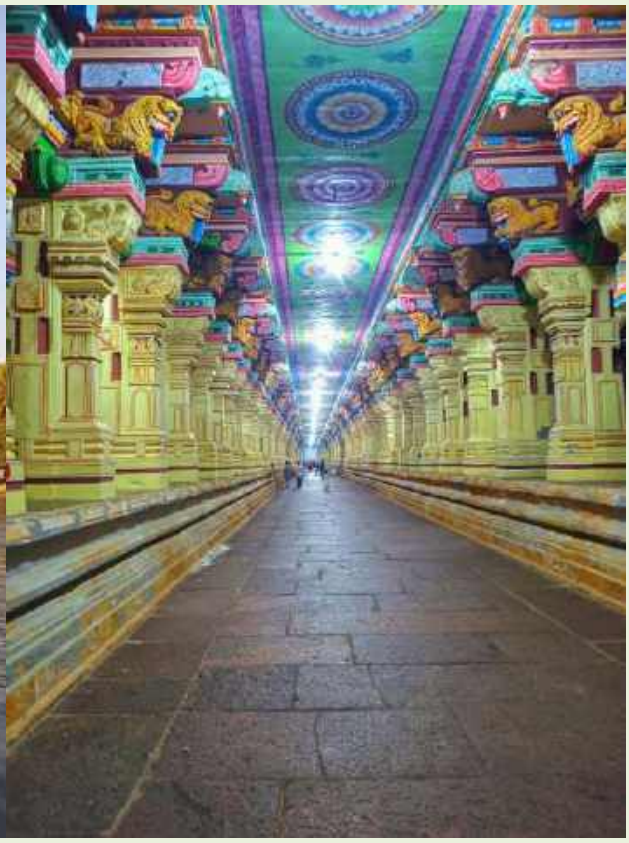
At Tadoba, we observed the complexities of managing high-density tiger populations alongside tourism and human-wildlife conflict. Pench highlighted the importance of corridors and landscape-level planning, while Tipeshwar emphasized the ecological value of lesser-known protected areas.

Institutional visits to the Chandrapur Forest Academy and operational exposure at the Balarshah Timber Depot introduced us to training systems, timber management, transit regulations, and the often-unseen administrative responsibilities that sustain forestry operations.

South India Tour (October-November,2024)

The South India Tour immersed us in the ecological richness and subtlety of the Western Ghats. Visits to Bandipur National Park, Mudumalai Tiger Reserve, and adjoining landscapes revealed dense forests, elephant corridors, and complex human-wildlife interfaces.

One of the most profound experiences of this tour was encountering the shola-grassland ecosystems-ancient, fragile, and uniquely adapted to high-altitude conditions. Walking through the mist-laden sholas made us aware of how delicately balanced these ecosystems are, and how irreversible the damage can be if they are mismanaged.



Our visit to Mukurthi National Park left a lasting imprint on our lives. The quiet resilience of the landscape, the harsh climatic conditions, and the simplicity of protection mechanisms highlighted a form of conservation that relies more on restraint than intervention. Mukurthi taught us that sometimes, the greatest act of conservation is knowing when not to interfere.

East India Tour: Home Through New Eyes (January-February, 2025)

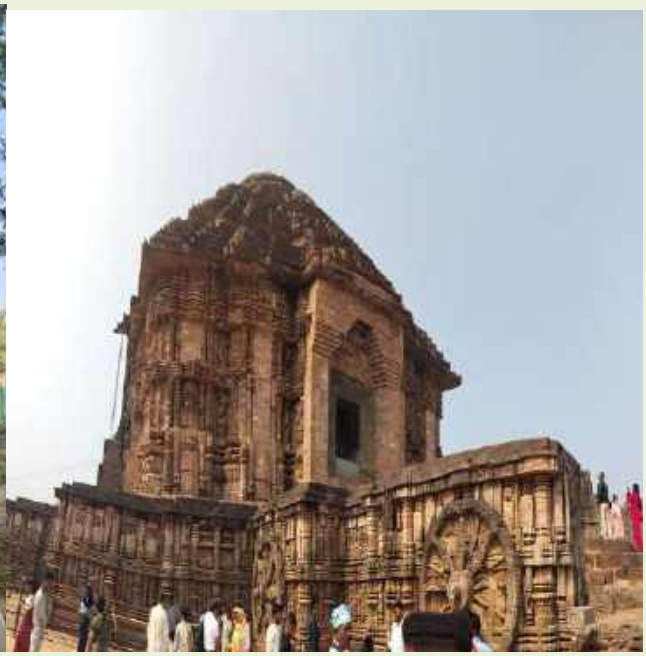
The East India Tour held particular significance for us, as trainees hailing from Assam. Visiting eastern India and our home state-not as residents but as Forest Range Officer trainees offered a profoundly different perspective.

In Kaziranga National Park, we studied floodplain ecology, Rhino conservation strategies, and anti-poaching mechanisms in a landscape constantly reshaped by the Brahmaputra's floods. Familiar terrain now revealed layers of administrative and ecological complexity.

At Manas National Park, lessons in post-conflict ecological restoration, transboundary conservation, and community participation highlighted the resilience of ecosystems and institutions alike. Assam, once simply home, now

emerged as a future responsibility.

Our visit to Singalila National Park was among the most defining experiences of the entire Bharat Darshan. The difficult terrain, extreme weather conditions, and logistical challenges offered a stark glimpse into the realities of forestry in remote and inhospitable regions. Singalila showed us that the life of a forester is often one of isolation, endurance, and quiet perseverance-where commitment matters more than comfort.



Another incident during our visit to Nameri National Park left an indelible mark on us. While returning in the evening, darkness descended rapidly, and the sandy riverine ground made movement difficult. Suddenly, we found ourselves being chased by elephants. In that moment, there was no buffer of theory-only instinct, fear, and the raw power of the forest. We ran for our lives. For the first time, many of us experienced real fear-the kind that strips away complacency and replaces it with deep respect. That evening at Nameri taught us a truth impossible to simulate in training halls: that the profession we have chosen is uncertain, demanding, and often dangerous.

West-Central India Tour (July-August, 2025)

The West and Central India Tour exposed us to dry deciduous forests, scrublands, and grassland ecosystems. These landscapes highlighted challenges such as forest fires, grazing pressure, habitat fragmentation, and

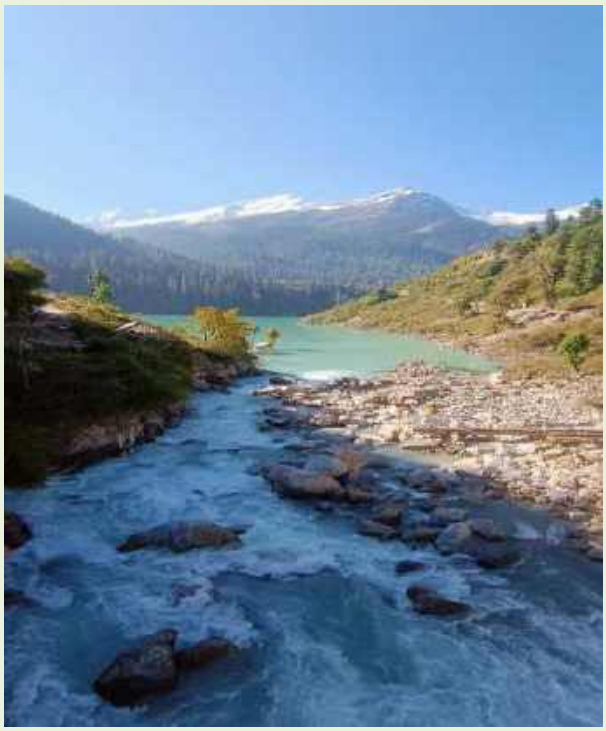
protection forestry in multi-use areas. This Tour took us through some of the country's most iconic conservation landscapes, each offering a distinct lesson in wildlife management and protection forestry.

At Khijadia Bird Sanctuary, we were introduced to the importance of wetland conservation and avifaunal diversity beyond traditional forest ecosystems. Gir National Park stood out as a powerful example of successful species-specific conservation, where the recovery of the Asiatic lion illustrated the strength of long-term protection and community coexistence. Kuno National Park offered insights into future-oriented conservation, highlighting the patience and planning required in habitat restoration and landscape preparedness. Our visits to Kanha, Bandhavgarh, and Ranthambore National Parks immersed us in the core of India's tiger landscapes, each presenting unique challenges related to prey management, tourism regulation, and human - wildlife conflict. We observed adaptive management strategies suited to climatically stressed regions and learnt the importance of strong field leadership. This tour reinforced that conservation is sustained not by occasional interventions, but by consistent, ground-level vigilance.

North India Tour (October - November, 2025)

The North India Tour introduced us to forest ecosystems shaped by altitude, fragile terrain, and climatic extremes. Forestry here extended beyond wildlife protection to encompass watershed management, soil conservation, and ecological security. Our visits to Sukhna Wildlife Sanctuary, Thajwas Wildlife

Sanctuary, and Gulmarg Wildlife Sanctuary introduced us to forest management in fragile and climatically sensitive landscapes. These areas highlighted the challenges of conservation in regions marked by steep terrain, seasonal extremes, and high tourism pressure. The exposure to Dal Lake restoration works further broadened our understanding of ecological management beyond forests, demonstrating how wetland and lake restoration require coordinated planning, long-term monitoring, and sustained administrative effort.



Together, these experiences emphasized the role of a forester in safeguarding ecological security in vulnerable landscapes where conservation and human

use intersect closely. These landscapes reaffirmed that forest management in India cannot follow a uniform template. Each region demands approaches shaped by its geography, people, and ecological limits.

Bharat Darshan: Unity in Diversity, Felt and Lived

Since childhood, we have read in our textbooks that India is a land of unity in diversity. Bharat Darshan did not merely teach us this phrase - it made us feel it. Across forest types, cultures, institutions, and terrains, the diversity was immense, yet bound together by a shared commitment to conservation. Traveling together as a batch strengthened our collective identity and revealed forestry as a national endeavour rooted in local realities.

Conclusion: Bringing Bharat Back Home

For a forester, training does not end with completion - it begins with responsibility. As Forest Range Officer trainees from Assam, the experiences and lessons gathered from Bharat Darshan now accompany us as we prepare to take charge of our respective ranges. Exposure to conservation practices across India - tiger landscapes in central India, elephant habitats in the south, community-based conservation in the east, and terrain-specific forestry in the north-has equipped us with perspective and judgement. When we return to serve in Assam, these learnings will guide our approach to floodplain management, human - wildlife conflict mitigation, habitat protection, and community engagement.

Bharat Darshan has taught us not to replicate models blindly, but to adapt best practices thoughtfully. We step into service carrying the essence of India's forests within us - committed to safeguarding Assam's natural heritage with knowledge drawn from across the nation, humility learnt from experience, and respect born from the forest itself.

TELANGANA STATE FOREST ACADEMY

11th Batch Forest Range Officers ITP

24.06.2024 to 23.12.2025