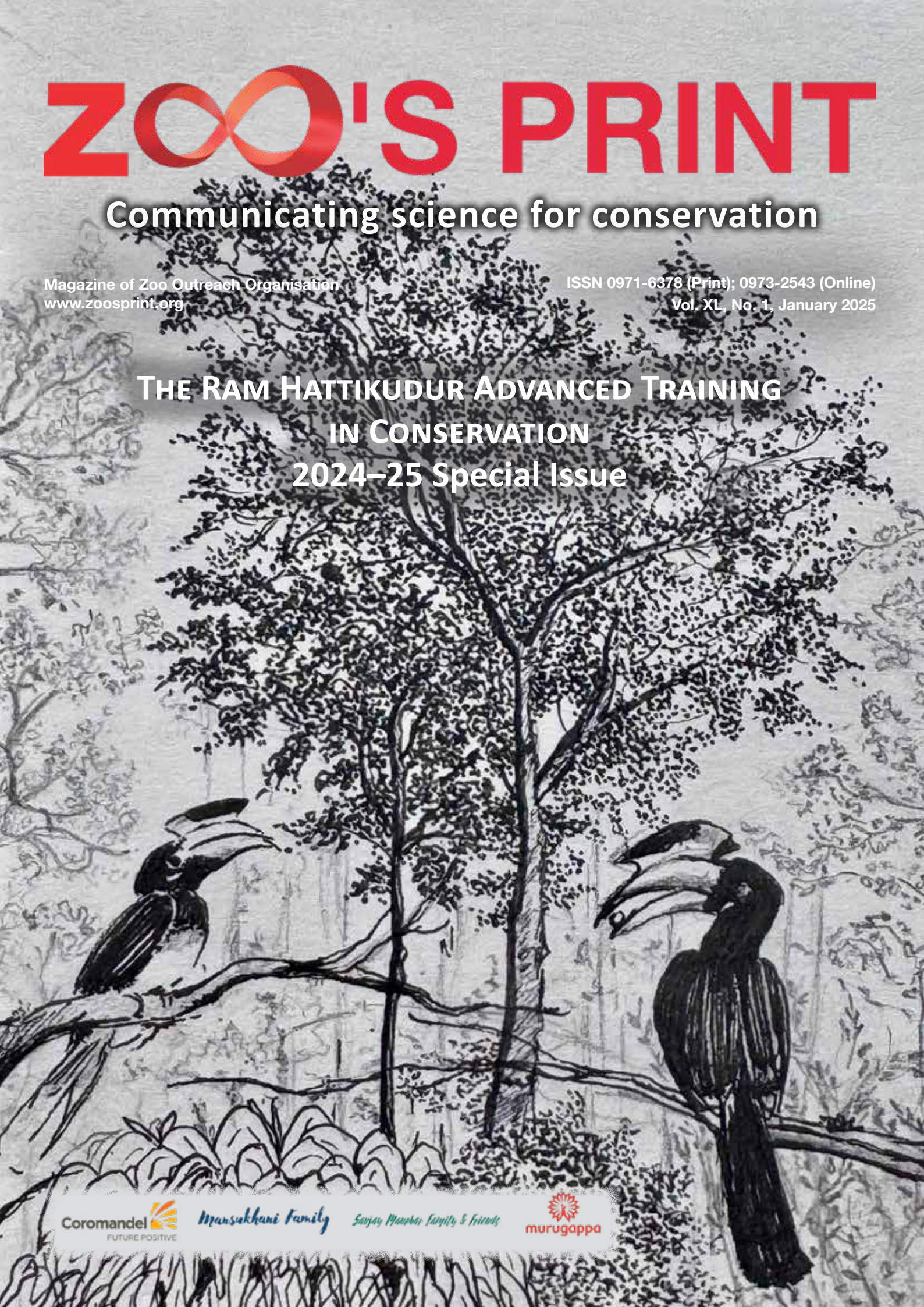
ZOO'S PRINT

Communicating science for conservation

Magazine of Zoo Outreach Organisation
www.zoosprint.org

ISSN 0971-6378 (Print); 0973-2543 (Online)
Vol. XL, No. 1, January 2025

The Ram Hattikudur Advanced Training in Conservation 2024–25 Special Issue



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Malabar Pied Hornbill pair on Ratnagiri plateau, Maharashtra in pencil and ink by Ananditha Pascal and Dupati Poojitha.

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RHATC 24–25 Special Issue

Editorial - Building Conservation Leaders: 40 Years of Zoo Outreach Organisation.

Time flies. Zoo Outreach Organisation is 40 years old, and I have been with it for over 31 years! 2025 is special for all of us at the organization as we step into the 40th year of its founding by Sally Walker, who came to India to learn yoga but ended up dedicating her life to uplifting the image and functioning of zoos in India and later to the conservation of India's fauna, flora, and funga. Her influence was felt beyond the borders of India, reaching South Asia and the rest of the world.

Little did I know, as a school student visiting Mysore Zoo in the early 1980s and excitedly watching a white woman walking tigers, that two decades later I would be working with her on conservation. Having spent innumerable hours with Sally since 1993, I had the privilege of listening to her adventures, experiences, and conflicts—both personal and professional. These interactions not only helped me understand her as a person but also provided a solid foundation for viewing conservation actions from perspectives that transcend personal boundaries of ego and selfishness. When Sally asked me to join ZOO in 1993, I had no idea of the adventures I would undertake, nor did I imagine lasting this long in conservation. However, being thrust into conservation planning workshops just two months after joining (where I initially had no clue about what was going on) and the opportunity to grow through exposure to experts in the field significantly contributed to my development as a conservation biologist and practitioner.

When the opportunity for formal training in conservation arose, I spent two months at the Field Museum in Chicago. Dr. Larry Heaney, who initiated the Advanced Training in Conservation for interested candidates from around the world, became a pivotal mentor. I absorbed knowledge from him, his team of mentors, and Dr. Bob Lacy at the Brookfield Zoo like a sponge. During my U.S. trip in 1994, I also had the privilege of participating in the first advanced training in facilitation conducted by the Captive Breeding (now Conservation Planning) Specialist Group in Minneapolis. Dr. Ulie Seal's philosophy of conservation set me on a course that I continue to pursue three decades later.

The combination of these trainings has always remained at the forefront of my mind. When the first opportunity to establish an integrated training program for budding Indian conservationists arose, I seized it. Although it took over two and a half decades to come to fruition, it's never too late. India has had several courses in conservation, but these have often been narrowly focused. None compare to the Ram Hattikudur Advanced Training in Conservation (RHATC), now in its fourth year, which trains and upskills the latest batch of 10 Indian conservationists from nine states to become leaders in the field. The RHATC course is unlike any academic program in wildlife or conservation offered in the country, nor is it particularly long. The course has been designed to leverage the fellows' existing skillsets and organically foster their understanding and growth as potential leaders. It is informal in structure yet deeply rooted in serious activities, teaching, and training. Fellows are expected to make the most of the opportunities provided and to fully engage in exercises, assignments, case studies, field trips, and exposures, all of which are integral to their holistic training in conservation.

It gives me great pleasure to present yet another special issue this year by the RHATC batch four. The fellows have contributed in parts to previous issues of Zoo's Print, but this issue is dedicated entirely to RHATC batch four, allowing them to showcase their learnings, field trips, assignments, campaigns, mentor profiles, leader profiles, educational materials, discussions, posters, and more.

The Ram Hattikudur Advanced Training in Conservation is made possible thanks to the generous donations of the Mansukhani family, the Sanjay Manohar family and friends, and CSR support from Coromandel International. I extend my heartfelt thanks to the many mentors, experts, field assistants, leaders, and others who have contributed to this program's success. Finally, I thank my team of committed colleagues and conservationists from Zoo Outreach Organisation, without whom this dream would not have become a reality. To the fellows, I hope that all 40 of you do justice to the training you have received, having committed yourselves to the cause and joined the leadership program. My very best to all of you, and I reiterate my support whenever it is needed.

Dr. Sanjay Molur
Course Director, RHATC
Executive Director, Zooreach

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Ram Hattikudur
Advanced Training in Conservation

Insights into the Ecology of Asiatic Lions by Dr. Meena Venkataraman

We had the privilege of attending an insightful two-day session (9–10 December 2024) led by Dr. Meena Venkataraman, a renowned wildlife biologist with over 15 years of experience researching Asiatic Lions.

Day 1: Stakeholder Role-Playing and Action Planning

The first day we had an interactive activity where participants enacted the roles of various stakeholders to address a real-life conservation issue. The scenario involved wolf attacks on humans in the village of Bahraich, Uttar Pradesh, from March to September 2024. The stakeholders represented included villagers, the forest department, an NGO, media personnel, and the police.

Each stakeholder group presented an action plan, explaining their role in mitigating the conflict and contributing to a solution. This thought-provoking exercise provided us with a deeper understanding of how different stakeholders are impacted by and contribute to solving conservation challenges. It highlighted the complexity of real-world issues and the importance of collaboration and communication between diverse societal roles.

Day 2: Insights into the Asiatic Lions of Gir National Park

The second day was dedicated to an in-depth session on the Asiatic Lions of Gir National Park, Gujarat. Meena provided fascinating insights into their behavior, biology, and conservation challenges. We learned that lions now inhabit only 8% of their historical range, primarily in Gir National Park. As the only social cats, lions live in structured groups: female lions form a pride, while male lions form a coalition.

- **Male lions:** At 3–4 years of age, male cubs leave or are forced out of their groups, forming coalitions with other males, often brothers or unrelated males. By 4–5 years, they establish territories, find a pride, and mate. However, 2–3 years after this, they may become nomadic.
- **Female lions:** Female cubs tend to stay closer to their home ranges. At 3–11 years of age, they breed and collectively care for cubs. Female lions live longer (up to 18 years) compared to males.

An intriguing aspect of lion behavior discussed was infanticide. Male lions may kill cubs from other males to make the females receptive to mating, leading to intense territorial and mating competition.

Research Methods and Conservation

Meena also explained methods used to identify individual lions, such as analysing the unique whisker spot patterns on the second row (referred to as the "B row").

For translocations, it is recommended to release a higher number of lions into the core zone rather than the buffer zone to minimize stress and improve survival rates.

Community Perspectives and Translocation Discussions

The session also explored community perspectives on conserving lions and leopards. Interestingly, communities coexisting with both species showed more acceptance toward lions than leopards.

We concluded with discussions on the translocation of cheetahs to Kuno National Park and the potential for translocating lions to the same area.

Gratitude

This session was an incredible opportunity to learn from Dr. Meena Venkataraman's vast expertise. We are immensely grateful to the Zoo Outreach Organisation and to the Ram Hattikudur Advanced Training in Conservation for facilitating this enriching experience, and to Dr. Meena for sharing her invaluable knowledge.

Dupati Poojitha, RHATC Fellow 2024–25, Zoo Outreach Organisation, Coimbatore, Tamil Nadu, India.

Saving the Dark: A Session by Sriram Murali and Chandrashekar Rathnam on Fireflies

"Stars on the ground" — this is the phrase that comes to mind when we recall the magical sight of fireflies glowing around us, 50 km away from Coimbatore. The mesmerizing experience felt like stepping into a fairy tale, all made possible by two passionate individuals, Sriram Murali and Chandrashekar Rathnam, whose love for stargazing and wildlife brought us to this enchanting place.

Sriram Murali, once an employee at Google, has been a stargazing enthusiast for many years. His journey began with a simple bet with his family and friends — he wanted to prove that capturing the brilliance of a star-filled sky was possible, even in a world overwhelmed by light pollution. Determined to succeed, he created a breathtaking video that showcased how artificial light obstructs starlight from reaching Earth. Using the Bortle scale, which rates sky darkness from 1 (darkest) to 9, his video vividly contrasted pristine skies with those polluted by artificial light. The film earned him international acclaim, annual awards, and widespread recognition for his exceptional storytelling and filming skills.

A pivotal moment in Sriram's life came during a visit to Anamalai, where he encountered hundreds of fireflies alongside his friend Chandrashekar. Inspired by the ethereal beauty of these "stars on the ground," he photographed the fireflies, creating images that went viral and earned him prestigious photography awards. Though he continued his corporate job, Sriram's heart remained in the magical landscapes where he experienced awe and wonder with fireflies. This profound connection eventually led him back to India, where he decided to dedicate his life to preserving the beauty of the night.

Together with Chandrashekar, Sriram founded Wild and Dark Earth (WiDE), an NGO aimed at raising awareness about fireflies and the

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detrimental effects of light pollution. Their work involves ongoing research, conservation advocacy, and community outreach to inspire action. They emphasized restoring darkness by retrofitting lights, as darkness and temperature play a crucial role in triggering fireflies' glowing patterns. Their research also investigates how different colors of light impact fireflies, highlighting the complex relationship between artificial lighting and these enchanting creatures.

During our time in the Ram Hattikudur Advance Training in Conservation, Sriram and Chandrashekar taught us about the challenges for firefly emergences and strategies to address them. He presented a video that beautifully captured the impact of light pollution on the night sky. One particular quote resonated deeply: "The story of nocturnal life got support from the role of the diurnal life". This thought-provoking statement emphasized the interconnectedness of diurnal and nocturnal species and the need to view them as part of a cohesive ecosystem.

We also learned about the fascinating ecology of fireflies. Firefly larvae are voracious predators, consuming 5–10 leeches per night. They use mandibles to inject venom into their prey, paralyzing it before cutting the flesh into smaller pieces, dissolving it with digestive enzymes, and consuming it. When fully grown, most firefly larvae pupate underground or in rotting logs. Depending on moisture availability, pupae delay their emergence until suitable leaves appear. Fireflies are commonly found in teak and rosewood plantations, where they lay up to 50 eggs in moist leaf litter. Major threats to fireflies include habitat loss, light pollution, and increased pesticide use.

The conservation efforts shared by Sriram and Chandrashekar include studying the correlation between sky brightness and firefly flash density, examining the effects of light spill from adjoining properties versus distant light sources, and collaborating with experts to design environment-friendly lighting guidelines. They also conduct outreach programs to raise public awareness. They presented a sustainable

method for pesticide use, suggesting that instead of spraying chemicals across plants, pesticides should be buried in soil and covered. This approach minimizes harm to fireflies and other insects, promoting a more sustainable solution to pest control.

After having this session, we went to Pollachi to see fireflies in the wild in Aatral, led by Saravanan. We observed the firefly emergence starting at around 7 PM. On the ground, we noticed some firefly larvae crawling around. We also witnessed firsthand the impact of light pollution on firefly populations. In a farm affected by light pollution from a nearby petrol pump, the firefly population was noticeably sparse compared to the areas with less light pollution, where the number of fireflies was abundant.

One particularly enticing incident was observing a male firefly mimicking the signal pattern of a female. Our interpretation of this behavior was that the male might be attempting to eliminate competition from other males. We also observed different flashing patterns, mating behaviors, and social interactions among the fireflies.

This session not only deepened our understanding of firefly conservation but also inspired us to contribute actively to preserving these luminous marvels of nature. The passion and dedication exhibited by Sriram and Chandrashekar stand as a testament to the impact individuals can have in driving meaningful change.

Acknowledgement:
We would like to express our gratitude to for the opportunity provided to us to gain knowledge on firefly conservation during the Ram Hattikudur Advanced Training in Conservation course at Zoo Outreach Organisation. This exercise has been instrumental in helping us deepen our understanding of the real threats to fireflies and the conservation methods required to address them. We would also like to convey our thanks to Mr. Sriram Murali and Mr. Chandrasekhar Rathnam for allowing us to get insights on the challenges we will encounter as emerging conservationists, particularly in addressing issues such as light pollution and pesticide usage. We are truly grateful for this insightful experience, which will significantly guide our future efforts in conservation.

Diya Banerjee & Dupati Poojitha
RHATC Fellows 2024–25, Zoo Outreach Organisation, Coimbatore, Tamil Nadu, India.

Hard Life, on The Rocks: Exploring the Resilience of Life on Rocky Outcrops with Aparna Watve

Rocky outcrops - harsh, rugged landscapes - are often perceived as barren and lifeless. However, beneath their tough exterior lies a world of resilience, adaptation, and hidden biodiversity. They are not just lifeless terrains, but vibrant ecosystems that tell the story of evolution and human interaction with nature. They have stood the test of time, supporting life in the harshest of conditions. Over three enlightening days, Dr. Aparna Watve who calls herself 'a taxonomist by training, an ecologist by choice' guided us through the fascinating world of these unique landscapes, covering various aspects of rocky outcrops, including their classification, biodiversity, life processes, and their deep-rooted connection with human civilizations followed by the need for conservation of these ecosystems. Dr. Watve has over 25 years of experience working in these landscapes, focusing on the Western Ghats Biodiversity Hotspot. From understanding their formation to exploring the adaptive strategies of life that thrive within them, this journey revealed the true essence of resilience.

Rocky Outcrops - Nature's Sculpted Masterpieces

Dr. Watve introduced us to rocky outcrops as the visible exposures of bedrock or ancient superficial deposits on the Earth's surface. These landscapes are formed through complex geological processes such as weathering and erosion, shaping their unique characteristics. Different types of rocky outcrops discussed include:

Inselbergs: Isolated rock formations rising above plains, commonly composed of granite and gneiss.

Karst Landscapes: Formed from the dissolution of soluble carbonate rocks like limestone and dolomite, resulting in caves, sinkholes, and underground rivers.

Duricrust Plateaus: Hard, flat rocky surfaces such as laterite or ferricrete landscapes seen in peninsular India.

Flood Basalt Formations: Large expanses of basaltic rock resulting from volcanic eruptions, forming plateaus like the Deccan Traps.

Different types of plateau formations include ferricrete laterite plateaus, columnar basalts, coastal laterites, and marble cliffs. Marble cliffs, for instance, are found in Jabalpur. In the Satara district, at about 1,200 meters above sea level, exposed basalt blocks can be observed, which harbor rich endemic flora and fauna. These regions often feature ancient human and crop paintings on cave walls, typically on lateritic rocks. A notable example is the Idukki cave paintings in Kerala.

Rocky outcrops also serve as crucial catchment areas, collecting water that is used for various activities such as drinking and irrigation. Systems like the 'Pat' system in Kerala and Maharashtra utilize the water from these rocky outcrops. Additionally, ancient grinding holes, or 'sursunga' systems, can often be seen on these rocks, used historically for grinding rice, coconut, or other materials. For example, potholes in Pune (e.g., Nighoj potholes) are a significant geological feature.

The Building Blocks – Components of Rocky Outcrops

Rocky outcrops are characterized by a unique interplay of abiotic and biotic components that shape their ecosystems. The macroclimate of these regions is often harsh, with high exposure to sunlight, extreme temperatures, and limited water availability. However, microclimates, such as shaded crevices and depressions, create localized environments where life can thrive. Soil formation on these outcrops is minimal, with edaphic factors significantly influencing vegetation patterns. Rainwater pooling in depressions supports ephemeral life, but the scarcity of nutrients necessitates innovative adaptations among organisms. The flora includes lichens and mosses that form biological crusts, as well as ephemeral plants and succulents adapted to these challenging conditions. Meanwhile, the fauna comprises specialized herbivores, carnivores, and omnivores that rely on these vegetation forms for sustenance, further showcasing the delicate balance of life on rocky outcrops.

The Silent Architects: Ecosystem Processes

Rocky outcrops are dynamic ecosystems shaped by natural processes over time. Soil formation, though slow, is a vital process driven by rock weathering and the decomposition of organic matter, creating the foundation for life. Ecological succession on these outcrops is gradual, influenced by the limited availability of space and resources, leading to the replacement of species over time. Disturbances such as seasonal droughts, grazing, and fire play a significant role in shaping survival strategies, with species like *Tripogon lisboae* exhibiting desiccation tolerance to endure extreme droughts. Plants and animals demonstrate remarkable adaptations to nutrient scarcity, including carnivory, dormancy during unfavourable periods, and succulence for water storage. These habitats also support diverse microhabitats, such as cryptogamic crusts formed by lichens and mosses, seasonal rock pools that harbour aquatic life during rains, and ephemeral flush vegetation that emerges briefly during wet periods, highlighting the complex interplay of ecological processes in these unique landscapes.

Survivors of the Stone: Adaptive Flora and Fauna

The flora and fauna of rocky outcrops demonstrate remarkable adaptations to survive in this challenging environment. The vegetation includes graminoids such as Poaceae and Cyperaceae, which are grass-

like plants capable of thriving on minimal soil, and non-graminoid species like *Ceropegia attenuata* and *Iphigenia ratnagirica*, uniquely suited to the rocky terrain. Succulent plants, with their ability to store water in fleshy leaves, flourish in the dry conditions of these habitats. The fauna is equally fascinating, with freshwater invertebrates like shrimps and insects relying on seasonal pools for survival. Reptiles, such as the endemic gecko *Hemidactylus satarensis*, exhibit remarkable camouflage against the rocks, while amphibians like the Koyna and Amboli toads endure prolonged dry periods by entering dormancy. Together, these species showcase the incredible biodiversity and resilience of life on rocky outcrops.

Adapting to Extremes – The Art of Survival

Dr. Aparna highlighted the remarkable survival strategies of plants and animals on rocky outcrops, focusing on their adaptations to the harsh environment. To manage water scarcity, succulents store water in their fleshy tissues to endure prolonged dry spells, while ephemeral plants complete their entire life cycle rapidly during the short monsoon season. Nutrient acquisition is another challenge, addressed by carnivorous plants like *Utricularia* (bladderworts) that derive essential nutrients by trapping insects, and plants with underground storage organs, such as tubers, that conserve energy and sustain them through long droughts. Mass blooming is a striking adaptation, where plants bloom synchronously during brief favorable conditions to maximize pollination opportunities. Aparna also discussed the ecological roles of herbivory and burning, explaining how such disturbances shape the balance of these ecosystems. Life on rocky outcrops is a testament to ingenuity, with species evolving specialized traits to survive and thrive in this challenging environment.

Cultural Connections – Where Nature Meets History

Rocky outcrops are not only ecological havens but also significant cultural treasures, serving as cradles of human civilization for millennia. These landscapes have provided shelter, water, and inspiration, leaving a lasting mark on human history. Ancient water systems, such as the Sursunga grinding holes used for grain processing, are still visible on outcrops in Pune, alongside natural wonders like the famous Nighoj potholes. Architectural marvels like the rock-cut temples of Mahabalipuram in Tamil Nadu showcase the ingenuity and craftsmanship of early civilizations. Additionally, sacred sites such as Uluru in Australia and Pandav Leni in Maharashtra reflect the profound spiritual connections humans have forged with these rugged landscapes, blending nature and culture into enduring symbols of heritage.

Conservation Challenges – A Fragile Future

Despite their resilience, rocky outcrops are highly vulnerable to urbanization, mining, and climate change. Aparna emphasized the Urban Cliff Hypothesis, which suggests that cities have unintentionally preserved structures of these rocky outcrops by incorporating them into urban

landscapes. However, to ensure their long-term survival, more proactive conservation measures are needed. Recognizing rocky outcrops as geo-heritage sites through mapping and legal protection can help safeguard these ecological treasures. Community engagement plays a crucial role in conservation efforts by raising awareness among local populations and fostering a sense of stewardship. Developing sustainable tourism initiatives that encourage responsible exploration can provide economic benefits while ensuring minimal environmental impact. Additionally, continued scientific research is essential to deepen our understanding of the ecological dynamics of these unique habitats, enabling better management and protection strategies. Preserving them ensures that their ecological, cultural, and historical values are maintained for future generations.

Insights from the field – The Ratnagiri Report

Upon our arrival in Ratnagiri district, Maharashtra, we were captivated by the serene environment.

The landscape transitioned from the towering mountain ranges of the Western Ghats to rolling hills with flat tops locally known as "sada". These formations are a result of centuries of erosion, creating a unique ecological and geological environment. In the afternoon, Aparna introduced us to key individuals involved in local conservation efforts: Sonali Mestry (gram sarpanch), Manali Rane (Bombay Environmental Action Group member), and Gurjar Kaka, an engineer documenting the region's biodiversity, including bird diversity. During our informal discussion over vada pav brought by Manali, Aparna explained the significance of the sada landscape and how they have established a strong rapport with the local community to promote conservation. This ecosystem, often dismissed as barren land, supports a unique biodiversity and is crucial to the cultural and natural heritage of the region. We also introduced ourselves and shared details about our mentorship projects, receiving insights on how local communities and researchers collaborate effectively in conservation.

The next day, we visited the Kasheli geoglyphs in the Konkan region, a significant archaeological site discovered in May 2016. We met Sudhir Risbud and his team from Nisarga Yatri Sanstha, who are actively working to preserve these geoglyphs. Aparna and Sudhir elaborated on the region's prehistoric rock art, which dates from the Mesolithic to early historic periods and serves as a key cultural and ecological record. At Kasheli, we observed India's largest geoglyph: a massive elephant figure (18 x 13 meters) containing carvings of various animals like sharks, tigers, and peacocks. These carvings document human creativity and adaptation to the region's ephemeral wetlands and enrich our understanding of the Konkan's prehistoric human activities.

On the final day, we presented our group project objectives to the mentors and experts, receiving valuable feedback to refine our approach. The session highlighted the significance of integrating cultural heritage with ecological conservation and emphasized the role of community involvement. Inspired by the rich knowledge shared by the experts and the breathtaking landscapes, we started our mentorship project with renewed zeal and a deeper appreciation of the challenges and opportunities in conservation work.

Conclusion

Dr. Aparna Watve's sessions were a revelation, offering a profound appreciation for the resilience of life on rocky outcrops. These ecosystems are not just geological formations; they are living museums of evolution, rich in biodiversity and cultural heritage.

As we move forward, it is crucial to recognize their importance and take meaningful steps to preserve these treasures for future generations. As Aparna said 'The rocks have sustained life for millions of years - now it's our turn to sustain them.'

Himangshu Kalita, Diya Banerjee & Mohsin Ahmad,
RHATC Fellows 2024–25, Zoo Outreach Organisation, Coimbatore, Tamil Nadu, India.

Bats, Geckos, and the Eastern Ghats: Taxonomy and Conservation Insights from the Srinivasulus

On the 24 and 25 of December, 2024 the fellows had the opportunity of interacting with the Batman and Batwoman of India—Dr C. Srinivasulu and Dr Bhargavi Srinivasulu—from Osmania University, Hyderabad. Being wildlife biologists and taxonomists, they have worked on birds, bats, reptiles, and fishes of southern India. The two-day interactive session began with an engaging introduction to bats and their taxonomy. Srinivasulu began by introducing the order Chiroptera, derived from the Greek words chiro (hand) and ptera (wing), highlighting the bats' extraordinary ability to achieve true flight, a rarity among mammals. He emphasized the critical role of taxonomy in conservation and highlighted the distribution of bats in India, particularly fruit bats along the eastern coast from Sri Lanka to Bangladesh. He explained their behaviour of hanging upside down, noting that it provides an ideal position during take-off for flying.

He shared fascinating details about megabats, explaining how they detect ripening fruits from as far as 30–40 kilometres and adapt to food scarcity in summer by consuming leaves. However, their echolocation abilities are not as developed as those of insectivorous bats, which rely on their advanced echolocation to hunt insects and other prey, including mice, frogs, lizards, small birds, and even other bats. He also described their unique reproductive biology, where females give birth to a single pup per breeding cycle, often carrying the pup during feeding or leaving it in maternity caves. Upon returning from foraging, mothers regurgitate food to feed their young.

The session also covered the intricacies of bat echolocation, with Srinivasulu explaining how bats use distinct call patterns for prey detection and social communication. He further emphasized the critical threats bats face, such as habitat loss, deforestation, agricultural expansion, and the widespread use of pesticides, which reduce insect populations. Roost disturbance, hunting for medicinal purposes, and local sustenance also contribute to their decline. Through this insightful session, he highlighted the ecological significance of bats and the urgent need for their conservation. His knowledge and passion for these remarkable mammals left us inspired and equipped to contribute to their protection.

The discussion also involved zoonotic diseases, particularly the Nipah virus outbreaks, which have been reported only in Kerala and Bangladesh. Srinivasulu explained that this could result from a combination of factors, including differences in medical systems, population density, ecosystem peculiarities, genetic variations, and human

activities. This session emphasized the need for a multidisciplinary approach to understanding and addressing zoonotic diseases.

Bhargavi then presented the inspiring conservation story of the Kolar Leaf-Nosed Bat, a species endemic to a single cave in Karnataka. Over a decade, their efforts transformed the site into a conservation reserve. She narrated the challenges they faced, including initial community resistance, and how engagement and education fostered local support. Their journey highlighted how taxonomic discoveries can lead to significant conservation milestones, inspiring participants to recognize the power of perseverance in conservation efforts.

Next day, the morning session was dedicated to reptilian taxonomy, focusing on the geckos of the Eastern Ghats. Srinivasulu illuminated the remarkable endemicity and biodiversity of the Eastern Ghats, which are far less studied compared to the Western Ghats. The session broadened our perspective on the ecological significance of the Eastern Ghats and the need for more comprehensive studies in this region. In the afternoon, their son Adithya Srinivasulu joined online to introduce the topic of predictive modelling in conservation. His work, part of his PhD research, explored how climate change and anthropogenic factors would affect the distribution of 110 bat species across South Asia by 2050 and 2070 using 19 climatic variables. His findings revealed that while some species remained unaffected, others faced severe impacts, challenging the generalized view that all species are equally vulnerable to climate change.

Adithya's presentation also emphasized the importance of utilizing available data efficiently and focusing conservation efforts on species-level studies to identify vulnerabilities and set priorities. This sparked a broader discussion on the balance between discovering new species and conserving known ones, urging researchers to take taxonomy to the next level by integrating it into conservation strategies.

The two-day session was a thought-provoking blend of taxonomy, conservation, and climate change discussions. It provided us with a deeper understanding of the complexities of conservation and the importance of interdisciplinary approaches. By linking taxonomy to conservation, exploring under-researched regions, and leveraging predictive modelling, the sessions underscored the need for innovative and informed strategies to address pressing conservation challenges.

Diya Banerjee & Sidharthan, RHATC Fellow 2024–25, Zoo Outreach Organisation, Coimbatore, Tamil Nadu, India.

Fellow Trails: Learning from the Alumni

As part of the Ram Hattikudur Advanced Training in Conservation course, we had the opportunity to interact with Supriya Samantha, an alumnus from the inaugural batch of RHATC, to gain insights into his experiences during his time at the course and shared valuable perspectives on how RHATC shaped his understanding of conservation and equipped him with essential skills. He also discussed his current endeavors in the field of conservation, shedding light on the projects he is actively involved in.

Presently, Supriya is working on biodiversity & ecosystem services monitoring and its response to climate change in the central Indian landscape. Always being fascinated in understanding effects of climate change and wanting to efficiently involve in mitigating it, previously he interned with Dr. Umesh Srinivasan at Global Change Lab in Indian Institute of Science, Bangalore from October 2021–April 2022. There he was part of the team identifying and understanding arthropods as bird food sources depending on Himalayan altitudinal gradient. It was quite interesting to understand his views on the relations altitudinal shift of birds has due to climate change.

Then he told us about his experience in RHATC course. He was quite nostalgic while talking about his memories and mentioned that RHATC was probably the most productive four months of his life. It was quite interesting and fascinating to know that this course not only taught him about the tools and techniques for wildlife conservation, but also gave life lessons which equipped him for his present projects, be it to do with workshop development, intragroup management, managing ego issue between the members of large team, project planning, stakeholder interaction etc.
Being part of the fourth batch and learning from someone who is quite an expert in his own field today after 3 years since the course, his journey serves as an inspiring example of how RHATC alumni continue to contribute meaningfully to conservation efforts, applying their learnings to create tangible impacts on the ground.

Shivangi Kanwar Chouhan, RHATC Fellow 2024–25, Zoo Outreach Organisation, Coimbatore, Tamil Nadu, India.

‘Climate Action Every-day’: Aparna Krishna's Guide to Sustainable Living for a Better Future

‘*Climate Change is not one person’s war; it is not a battle that can be fought by just one person or one group - it is a shared responsibility that requires collective effort and unity. Only by recognizing our interconnectedness and acting with shared purpose can we overcome this challenge and build a sustainable future for generations to come*’, says Aparna Krishna, a young engineer by profession, an environmentalist at heart, and a passionate enthusiast for sustainability and climate action, emphasizing the importance of individual actions in combating climate change.

In a world grappling with the devastating impacts of climate change, the question often arises: Can one individual truly make a difference? While many experts and policymakers debate the question and its possible answers, Aparna has her own answer to this question through her journey of transformation, resilience, and impactful action, serving as a source of inspiration - even for those of us directly pursuing careers in conservation through RHATC. Her philosophy, "Climate Action Every-day," is a call to adopt sustainable practices in our daily lives, contributing to a larger movement for environmental conservation.

Though most people have some awareness of climate change, the details often remain in a grey area. Aparna began her session by providing clear insights into climate change, sharing projections of future global temperature increases across various scenarios - from a ‘business as usual’ approach to the most optimistic pathways. Yet, the pressing question remains: ‘What happens if we fail to achieve our goals?’. The answers are deeply alarming: projections indicate that 30% of species could face extinction, mortality rates will rise significantly, sea levels will increase, submerging small island nations and coastal areas, equatorial regions may become uninhabitable, and economic losses will escalate to unprecedented levels - consequences that demand attention and action from every individual. Climate action is a survival need, and it should not always be a top-down approach. It can be a bottom-up approach too. Here, Aparna’s philosophy comes handy – we can make our little contributions to the greater cause, making the world a little better, or trying to do so, one step at a time.

The Concept of Everyday Climate Action

The idea of ‘Climate Action Everyday’ emphasizes incorporating eco-friendly practices seamlessly into daily life. Aparna Krishna champions a lifestyle where sustainability becomes a habit rather than a conscious effort or exception. She advocates for

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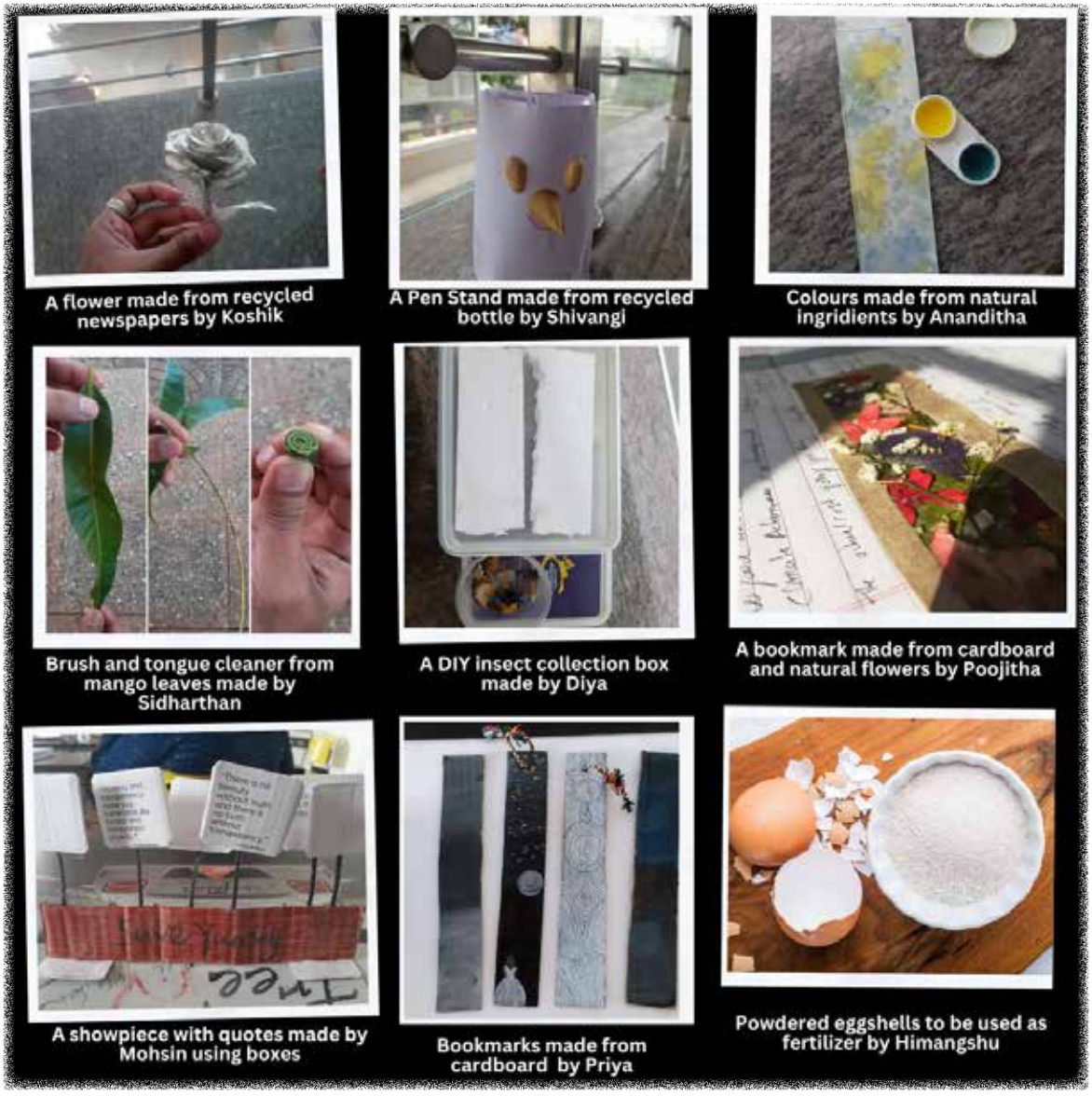

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small, consistent actions that, when multiplied across individuals, create a ripple effect capable of driving significant environmental change.

Aparna firmly believes that the key to achieving this lies in three fundamental elements: awareness, to understand the impact of our choices; accessibility, to ensure sustainable options are within reach; and a willingness to change, to embrace a lifestyle that prioritizes the planet. By adopting this approach, she shows that meaningful contributions toward combating climate change can stem from even the simplest acts in our everyday lives.

Aparna shared a picture of her garbage and asked us to guess how long it had taken her to accumulate that amount. Naturally, we miscalculated - we were off by years. Some of us guessed it represented a week's worth of waste, while others ventured it might be a month's. To our astonishment, Aparna revealed that the garbage had been accumulated over several years!

Her minimalist and sustainable lifestyle left us awestruck, showing how intentional living and mindful consumption can significantly reduce waste and leaving a low carbon footprint. It was a powerful reminder of what is achievable when sustainability becomes a way of life.

Key Pillars of a Sustainable Lifestyle

- **The 3R - Reduce, Reuse, Recycle**
  Aparna emphasizes the importance of minimizing waste. She encourages practices such as reusing household items, repurposing old materials, and ensuring that recyclable items are correctly processed. We learned that the true cost of a product goes far beyond just the physical waste it generates; it includes the entire chain of production, consumption, and disposal - a cycle that we have the power to break.

- **Sustainable Consumption**
  Choosing locally sourced, seasonal, and organic produce is a cornerstone of sustainable living. Aparna advocates for reducing the consumption of products with high carbon footprints, such as imported goods and heavily packaged items.

- **Energy Efficiency**
  Aparna encourages adopting energy-efficient technologies, such as LED lighting and solar panels, alongside simple habits like unplugging devices when not in use and optimizing heating and cooling systems. The small acts like switching off the lights while we leave the room can make an impact.

- **Water Conservation**
  Small actions like fixing leaks, using water-efficient appliances, and harvesting rainwater can contribute significantly to water conservation. Aparna highlights the interconnectedness of water use and climate sustainability.

- **Green Transportation**
  Aparna promotes walking, cycling, carpooling, and using public transport to reduce greenhouse gas emissions. For longer distances, we can explore the options of electric or hybrid vehicles.

Walking the Talk

Aparna's story began like many others - detached from environmental concerns, immersed in her career as an engineer at Bosch. However, something changed in her when she stumbled upon a video documenting the Kerala floods. That moment became a catalyst for her, sparking a realization about humanity's role in environmental degradation and her responsibility to be part of the solution. Since then, Aparna has embraced sustainability not just as a lifestyle but as a mission. She dedicates her weekends to volunteering for environmental initiatives, including lake clean-ups and community-based restoration projects. Her commitment extends to her personal life, where she ensures that all her products - from toothpaste to cleaning agents - are eco-friendly and plastic-free. She even reuses the unavoidable plastic that comes her way, ensuring minimal waste generation.

Aparna's advocacy doesn't stop with her own actions. She influences her peers and has successfully inspired many, including her friends and her roommate, to adopt eco-friendly practices. Even while gifting others, she goes for environment friendly options.

An Imperfect Environmentalist

Despite her extensive efforts, Aparna humbly calls herself an "imperfect environmentalist," a term that resonates with many of us who feel daunted by the complexity of sustainable living. Her honesty and authenticity make her relatable and inspiring, proving that no one needs to be perfect to contribute meaningfully to the planet's well-being.

After understanding the growing environmental crisis and our role in contributing to it, one might ask, "Should we just stop buying things?" The answer, of course, is no. It's not about completely ceasing consumption; rather, it's about making mindful choices and purchasing only what is truly essential.

We need to shift our perspective - seeking better, more sustainable alternatives and embracing practices that align with ecological well-being. Sometimes, the way forward lies in looking backward, drawing inspiration from traditional, low-impact ways of living that can guide us toward a

more sustainable future. Buying what we need and using what we have is the key!

Overcoming Challenges

Aparna's journey hasn't been without obstacles. Like many environmentalists, she faced scepticism and ridicule early on. Her preference for cleanliness drives over social outings made her the subject of jokes among friends. Yet, her persistence paid off, as these very friends began joining her in such activities, recognizing the importance of her mission.

Here she shares five important mantras to remember:

- **Be Kind to Yourself**
  Living sustainably is not easy, especially when it often means going against the norm. Aparna reminds us to practice self-compassion and recognize that small steps matter.
- **Embrace Imperfection**
  It's okay to be sustainable in one aspect of life and not in another. Sustainability is a journey, not a checklist, and progress is more important than perfection.
- **Avoid Extreme Idealism**
  Extreme idealism can serve as a vision, but life isn't about rigid binaries—it's about navigating the gradients. Aparna encourages a balanced approach that integrates sustainability into life in a practical and meaningful way.
- **Learn, Discuss, and Enjoy**
  Reading, exploring, and discussing environmental issues can be both enlightening and enjoyable. It's a powerful way to deepen understanding and find creative solutions while staying engaged and motivated.
- **Find Your Community**
  Building and being part of a like-minded community is vital for support, motivation, and collective action. Together, we can amplify our impact and inspire each other to do more for the planet.

These mantras serve as gentle reminders that sustainability is a collective and evolving process, one that requires patience, learning, and collaboration.

A Road for the Future

'Climate Action Everyday' is not just a slogan but a lifestyle that Aparna Krishna has championed. By adopting small yet impactful changes, individuals can significantly contribute to addressing climate change. Aparna's message is clear: the road to sustainability begins with everyday actions, and everyone has a role to play. In her words, "A sustainable future is built not by a few perfect efforts but by millions of imperfect actions."

Aparna Krishna's story stands as a powerful testament to the impact of individual action in inspiring collective change. Her journey reminds us that, while climate change can feel overwhelming, the path to a better future starts with each of us taking that first, decisive step.

Whether it's reducing plastic consumption, participating in community initiatives, or making mindful choices in our daily routines, every action, no matter how small, contributes to the larger cause. As Greta Thunberg wisely said, "You must take action. You must do the impossible. Because giving up is never an option." And perhaps even more poignantly, she reminds us that, "You are never too small to make a difference."

Aparna embodies these principles, showing that change begins with us and that our individual efforts can ripple outward, creating a wave of transformation.

Himangshu Kalita, RHATC Fellow 2024–25, Zoo Outreach Organisation, Coimbatore, Tamil Nadu, India.

Bahraich Wolf Attack Action Plan

SUMMARY

The Bahraich wolf attacks were a series of wolf attacks on humans that occurred between March and September 2024 in the Bahraich district in the Indian state of Uttar Pradesh. The attacks were suspected to be carried out by a pack of six wolves. The local villagers claimed that nearly 24 wolves may be involved, citing the sightings of the animals in the villages. The attacks began in March and peaked during the monsoon, resulting in the deaths of nine children and one woman, with over 50 people injured.

The Uttar Pradesh government declared the region a "Wildlife Disaster" area to expedite support for victims and control measures.

Scientist Y.V. Jhala commented that there is no definite proof to link these wolves to the attacks and the attacks might have been carried out by wolves or wolf-dog hybrids.

According to Amita Kanaujia of Lucknow University, climate change has resulted in flooding during the monsoons, which has altered the habitat of wolves. As a result, the wolves are often driven out of their traditional habitat and forced into human settlements in search of food.

Officials stated that either the animals might have been infected by Rabies or they might have started to attack humans for encroaching on their territory.

The Forest Department launched "Operation Bhediya," using drones and thermal cameras to track and capture the wolves. By September, five wolves were either captured or killed, and the final wolf was beaten to death by villagers in October after attempting another attack. The captured wolves were tranquilised and sent to Gorakhpur Zoo. This brought an end to the months-long crisis.

Following multiple attacks, the villagers feared for their lives and even killed a dog on suspicion.

The state government has conducted awareness campaigns in the area and the villagers were instructed to install doors to the houses. Night patrolling was conducted and solar-powered lights were installed in common areas. Dung and urine of Indian elephants were used in an effort to ward off the wolves from the populated villages. The government announced an ex-gratia financial assistance of ₹500,000 (US$6,000) to the deceased.

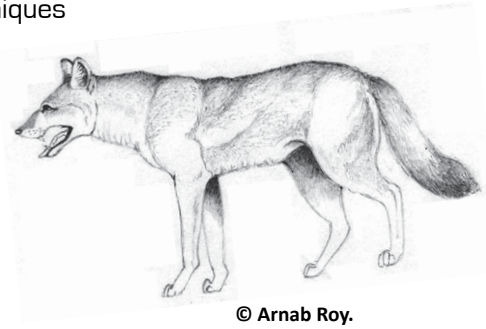
NEGATIVE IMPACTS RAISED BY THE VILLAGERS AND OTHER STAKEHOLDERS

Villagers:

- Villagers killed the wolves using brutal methods such as beating, which not only raised ethical concerns but also prevented scientific examination of the animals to confirm their involvement.
- Many villagers resorted to sleeping outdoors or on rooftops despite advisories. They formed vigilante groups that increased the risk of panic and unintended harm.

Forest Department:

- Despite early reports of incidents, the officials failed to take early action which would have caused less harm to the people.
- Inefficient techniques to capture the wolves delayed the operation causing long-time panic



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Police Department:

- The police faced criticism for not working effectively with forest officials and local leaders.

Media:

- Media reports sensationalized the attacks, causing panic and fear among residents.
- Media sidelined the educational information on preventing wildlife conflicts and various reasons for the conflict occurrence.

NGOs:

- Some NGOs tried to raise awareness, but their efforts were criticized as reactive and insufficient. Long-term measures to address human-wildlife negative interaction, such as habitat restoration or community training, were not effectively implemented.

Action Plan

The following is the outcome of a group activity where we assumed the roles of various stakeholders involved in the Bahraich wolf attacks. Without delving into the real-world scenario, we collaboratively outlined the perspectives and potential contributions of each stakeholder in addressing the issue. Additionally, we offered a critique of the roles and actions of other stakeholders.

VILLAGERS/SARPANCH

MAIN OBJECTIVE:

a) Villagers:

- Farming (Livestock, Agriculture).
- Selling the goods from the farming to the local market.
- Involving in local decision making.
- Protecting the family.
- Personal choice of cultivating crops in his land.

b) Sarpanch:

- Heads the Gram Panchayat in governance and development in the village.
- Acts as a representative of the village in government dealings.
- Maintains law and order in the village (Solving Conflicts).
- Makes decisions along with villagers' consultation.

ACTION PLAN

1. Assessing night guards in the village.

i. Equipping alerting system (Alerting systems like bells, WhatsApp group messages, etc.), which can be used by night guards to alert the villagers.

ii. Providing 24hrs basic first aid, medical and ambulance facilities.

iii. Assigning elders along with children while going to school or anywhere else.

iv. Avoid going out during dawn and dusk to mitigate unnecessary interaction.

v. Maintaining proper sanitation and hygiene in and around the village.

vi. Constructing proper street light facilities for enhanced visibility at night.

vii. Inform the forest department and other stakeholders like NGOs, the Police department, local government representatives, etc. to deal with and provide information about the incidents.

viii. In case the problem is not solved, inform the media with facts.

EVALUATION OF THE IMPACTS

The above action plan is just a temporary

solution that can raise awareness and reduce the interaction of villagers with animals. But for a permanent solution, all the stakeholders of government and non-government organisations and community involvement are necessary.

FOREST DEPARTMENT

Objectives of the Forest Department

- To safeguard human lives and livelihoods while adhering to the legal framework for wildlife protection.
- To manage and mitigate negative interactions between humans and wildlife, ensuring ethical, sustainable, and humane practices.
- To collaborate with all stakeholders for a balanced resolution that respects both ecological and social priorities.
- To foster trust and transparency with local communities by involving them in solutions and addressing their concerns promptly.
- To implement and recommend long-term strategies to minimize future conflicts and promote coexistence.

Action Plan

- The Forest Department formulated a detailed and action-oriented plan to address the immediate wolf attack crisis and lay the groundwork for future prevention.
- Immediate Steps:
- A specialized task force was deployed to locate and neutralize problematic wolves. This effort resulted in the elimination of five wolves and the capture of two, significantly reducing the immediate threat.
- The police were involved to maintain law and order, though their initial reluctance delayed critical actions, and their heavy-handed methods later caused unnecessary distress.
- Forest officials conducted on-ground surveys to ensure transparency and instill trust among affected families. Compensation was promptly announced for victims' families after thorough site assessments.
- Local communities were provided with walkie-talkies for real-time communication with the task force, improving response times and safety.

Long-Term Initiatives:

- Conduct awareness programs to educate communities about coexistence practices and the importance of reporting wildlife sightings.
- Implement sustainable solutions, such as the provision of cooking gas to reduce dependence on firewood and installing solar streetlights to deter nocturnal predators.
- Collaborate with scientific communities and NGOs to develop advanced tracking methods, ecological monitoring systems, and research on predator behavior.
- Advocate for the establishment of a Wildlife Conservation Act to complement the existing Wildlife Protection Act, enabling a holistic approach to human-wildlife coexistence.
- Create a rapid-response force equipped with advanced tools and training to manage similar crises in the future.

Evaluation of Actions Taken

The Forest Department successfully handled the crisis by neutralizing the immediate threat, compensating victims, and implementing community-friendly solutions. The provision of sustainable alternatives, such as solar streetlights and cooking gas, demonstrated a commitment to long-term coexistence. However, the operation exposed several challenges in stakeholder cooperation.

Despite these hurdles, the department's adherence to legal frameworks and ethical standards remained steadfast. While existing laws focus on protecting wildlife, the department ensured a balance between protecting endangered species and addressing human concerns, albeit constrained by the absence of broader conservation laws.

Police Force

Objectives:

i. Enforce and maintain law and order.

ii. Ensure welfare of the public.

iii. Work in collaboration with the local government.

Action plan:

i. Deploy an ambulance with all required medical facilities. Alert the Forest Department about the situation on ground.

ii. Reach the location at the earliest. Take measures to control and contain the agitated crowd.

iii. Ensure safety and restrict movement of both people and their livestock.

iv. Prevent gathering of the public and enforce a curfew if required.

v. Communicate and collaborate with the local government.

vi. Assist the Forest Department and provide the required human resource.

vii. Communicate the relief plans of the Forest Department with the community to ensure smooth and timely implementation.

viii. Regulate media presence at the site.

ix. For a long-term plan, collaborate with the locals to establish a reporting system which will strengthen vigilance, monitoring and reporting of wolf sightings in the area. This will aid the community in staying alert and minimize further encounters.

x. In extreme situations when the above action points fail to be implemented or are no longer appropriate to the situation, be prepared to cull the wolf provided the Forest Department has approved of the same.

Evaluation:

The police force is the point of first contact and is usually the first responder in conflict situations. The force is critical to enforcing law and order, especially in the presence of an agitated mob driven by emotion. If not contained efficiently, the mob outbreak can be fatal, which will in turn prevent the implementation of solutions. The Police Force is also required to assist and provide human resource to the already over-burdened Forest Department officials. They have a much-required role in serving as mediators between the Forest Department and the community.

Collaboration between the Police and the locals greatly contributes to the efficiency of establishing a monitoring and reporting system within the village. Such a system will increase the vigilance among the locals and reduce the probability of future encounters with wild animals.

Human Wildlife Coexistence promoters (NGO)

Objectives:

The primary goals are to raise funds for urgent conservation efforts, focusing on lesser-known species. The plan involves developing strong partnerships with forest departments, local stakeholders, and other organizations to create cohesive conservation strategies. Tailored conservation action plans will address specific threats to various species and their habitats.

Additionally, workshops and outreach programs will raise awareness and promote coexistence between communities and wildlife. The initiative also aims to empower local communities by creating sustainable livelihood opportunities that align with conservation goals, while educating and involving youth through training programs, mentorship, and volunteering.

Action Plan:

The first step involves engaging local communities to understand their concerns by holding meetings with the forest department, local people, and the police. A key action is recruiting and training night guards from the community for patrolling. Improving hygiene will be addressed by building toilets and managing waste properly. To ensure safety, additional lighting systems will be installed around villages, and villagers will be given torches for mobility. A reporting mechanism will be set up for villagers to quickly report wolf sightings. Regular evaluations will help adapt strategies based on feedback. A perception study will explore community attitudes towards wolves, while children will be engaged through educational programs to foster empathy. Other measures include setting up predator-proof livestock enclosures, training villagers in non-lethal deterrents, and conducting research on wolf behavior, ecology, and the root causes of wolf attacks. Collaboration with wildlife experts will involve monitoring wolf populations and restoring habitats to reduce human-wolf conflicts. Lastly, conservation translocation will be considered as a last option.

Evaluation:

The approach will build trust and address local issues, fostering community support for conservation through active involvement in decision-making. Employment opportunities will be provided, enhancing local ownership of conservation efforts. Measures to reduce fear and prevent wolf encounters will improve safety and reduce retaliatory actions. Timely responses and trust-building will enhance cooperation between communities and conservation authorities. Insights into causes of negative interactions will lead to tailored strategies, while efforts to engage youth will foster a pro-wildlife attitude. Livestock protection strategies will reduce economic strain and lower retaliation against wolves. The community will be empowered to handle conflicts sustainably, and scientific research will provide critical data for proactive management. Reducing wolf dependency on human settlements and preventing hybridization and disease spread will contribute to the long-term health of the wolf population.

MEDIA

The Objectives of a Journalist:

- Reporting of the on-ground situation and its development over time.
- Disseminate verified facts and not opinions at an appropriate time.
- Identify the key stakeholders and choose who and when to mobilize (Note: mobilize not instigate) for immediate action and long-term action.
- Promoting accountability and collective action.

Action Plan for the Wolf Attack Incidents:

1. Immediate Action-

- Speak to different stakeholders to understand the following:
  - Record of earlier similar incidents.
  - Perception study of what they think about the interaction and species.
  - What kind of support do they require and from which stakeholder?
- Mobilize police, forest department, NGOs, and communities for on-ground action.

- Mobilize the government for funds.
- Reporting of developments in the execution of the action plans they have claimed.

2. Long-term action-

- Mobilize conservationists for conservation-driven research.
- Reporting of further developments in the execution of the action plans they have claimed earlier.

Impact of Journalist's Action

In India, news and stories about wildlife and its associated challenges often struggle to gain the attention they deserve. However, this time was different. As journalists, our actions brought this issue into the spotlight, elevating it beyond regional boundaries and giving it unprecedented national visibility. While journalism is sometimes met with skepticism or criticism, this instance highlights the undeniable role we played in making wildlife conservation a matter of public concern.

An essential aspect of this incident was the fragmented response among the stakeholders involved. Many were preoccupied with promoting their individual contributions, seeking credit for addressing the issue, rather than recognizing it as a shared challenge. Unfortunately, the critical need for co-ordination and collaboration among different parties was largely overlooked. Addressing wildlife issues in isolation cannot lead to effective or sustainable solutions; it requires collective ownership and a unified approach.

This is where we, as journalists, stepped in. Recognizing the lack of synergy, we took it upon ourselves to bridge the communication gap. We reached out to each stakeholder individually - whether government officials - be it police or the forest department, conservationists, local communities, scientists, or NGOs - to document their perspectives, concerns, and needs. These diverse voices were then consolidated and broadcast to a wider audience, emphasizing the urgent need for collective action.

By highlighting the interdependence of stakeholders and framing the issue as a common concern, our reporting shifted the focus from individual achievements to the broader picture of sustainable resolution. Through our efforts, we not only informed the public but also acted as catalysts, encouraging dialogue and collaboration among all parties.

State Government

Objectives of the Government

- To protect citizens, livelihood, and ensure safety and well-being while ensuring adherence to laws governing wildlife protection and management.
- To establish effective coordination among various stakeholders to ensure swift and comprehensive action during crises.
- To foster public trust by addressing concerns, providing necessary resources, and maintaining transparency.
- To develop and implement long-term strategies to prevent similar incidents in the future, emphasizing preparedness, awareness, and collaboration.

Action Plan

The government, recognizing the gravity of the wolf attack crisis, implemented a robust and multi-faceted action plan to address the immediate concerns and lay the groundwork for long-term solutions.

Immediate Measures:

- A high-level meeting was held with local self-government authorities and the district administrative system to ensure a coordinated response.

- Compensation for affected families was prioritized, with the funds released immediately to alleviate their financial burden.
- The local MLA and the Minister of Forests visited the affected areas to analyze the situation, engage with the community, and reassure the public of their safety and the government's commitment.
- Orders were passed for the local government to install streetlights in the village on an urgent basis to reduce nocturnal wildlife movement and improve public safety.
- Regular school classes were temporarily suspended to ensure children's safety until the issue was resolved.
- An expert committee was formed under the district collector to monitor ongoing activities and provide strategic direction.
- Local NGOs were directed to maintain close contact with the community, raise awareness, and facilitate the implementation of government instructions.
- Media outlets were instructed to disseminate accurate, constructive information to assist both the public and the authorities in ensuring the smooth progression of operations.
- The Chief Wildlife Warden was authorized to capture all problematic wolves immediately. In cases where capture was deemed unfeasible due to terrain, weather, or other constraints, the warden was empowered to eliminate the animals on-site.

Long-Term Initiatives:

- Conduct specialized training programs for villagers and forest guards to tackle future human-wildlife conflicts effectively, with assistance from NGOs.
- Commission detailed studies by the scientific community to analyze the root causes of such incidents and devise preventive strategies.
- Develop educational campaigns to promote awareness about wildlife behavior and coexistence practices in vulnerable regions.
- Strengthen institutional frameworks for wildlife management, including the creation of rapid-response teams equipped to handle emergencies more effectively.

Evaluation of Actions Taken

The government's prompt and decisive actions ensured a timely response to the crisis. The quick disbursement of compensation funds and on-site visits by senior officials reassured the affected community and restored some semblance of order. The installation of streetlights and temporary suspension of school activities highlighted the government's commitment to public safety.

The expert committee's formation under the district collector brought much-needed structure and oversight to the operations. Moreover, empowering the Chief Wildlife Warden with authority to neutralize the immediate threat reflected a pragmatic approach to the situation. While the immediate actions mitigated the crisis, the government's focus on long-term strategies, including training, scientific research, and public awareness, was commendable. These measures aim to ensure preparedness and minimize the recurrence of such conflicts in the future.

Scientific community

Objective: To reduce negative interaction between human and animal

Plan of action:

i. Systemic identification of the species using camera trapping.

ii. Distribution and behavioral analysis of species.
   - Solitary or pack during hunting.
   - Feeding ecology.

iii. Molecular analysis to understand if its hybrid or wild species.

iv. Feral population and hybrid population.

v. Effect of land use change on Population trends of the species.

vi. Perception study of all relevant stakeholders.

vii. Monitoring movement through:
   - Direct methods: Camera trapping, locations decided as per local people's citing
   - Indirect method: Sign surveys and radio collaring.

viii. Livestock depredation monitoring and management.

ix. Education and outreach objectives to combat myths about the species and its behavior.

x. Last resort in case of negative interactions getting intensified Conservation translocation.

Criticism from the different stakeholders

Villagers point of view:

Forest Department:

Forest Department was slow to respond to the wolf attacks, with delays in action leading to more fatalities. The department lacked sufficient resources and coordination to track and capture the wolves effectively, leading to frustrations as the situation worsened.

Police:

The police was unable to do enough to prevent the escalation of the attacks.They didn't implement enough safety measures or provide adequate support during the crisis, and there was poor communication about the steps being taken to address the situation.

NGOs:

NGOs were seen as playing a minimal role in the crisis. They did not involved in providing immediate relief or helping with the wolf capture efforts. They did not addressed the root causes for the attacks.

Media:

The media sensationalized the attacks, causing unnecessary panic. Also inaccurate reporting, as the media focused more on dramatic aspects rather than offering clear, factual information about the causes of the attacks and expert opinions.

Government:

The state government was delayed response, only declaring the area a "Wildlife Disaster" after significant loss of life. While some financial assistance was provided, that felt like government focused too much on short-term solutions, neglecting long-term measures to address the underlying causes of the attacks.

Forest department point of view.

Local Community:

The community's initial violent outburst exacerbated the situation, resulting in unnecessary chaos. However, their subsequent cooperation in locating problematic wolves highlighted their potential as valuable partners in conflict management.

Police Department:

The role of the police was marred by their initial reluctance to assist, seemingly driven by ego and a desire to assert dominance. This delayed critical actions during the operation's early stages. Furthermore, their violent and heavy-handed

methods to control the mob were unnecessarily cruel, inciting fear and anger among the locals. Such behavior not only jeopardized trust but also strained inter-departmental collaboration.

NGOs:

While NGOs like the Wildlife Mitigators Organization provided valuable insights on species tracking and monitoring, their overemphasis on species protection came at the cost of neglecting human concerns. Their approach lacked empathy for the victims and their families, creating friction with the local community and undermining the broader objective of coexistence.

Media:

The media, instead of acting as a responsible informant, sensationalized the issue, spreading misinformation that the Forest Department prioritized wildlife protection over conservation. This narrative ignored the department's legal limitations and created unwarranted panic and chaos. The spread of false information damaged public perception and heightened tensions among stakeholders.

Government:

Although the government extended prompt support during the crisis, its passive stance on enacting broader conservation laws is a significant shortcoming. The absence of a Wildlife Conservation Act limits the ability to address human-wildlife conflicts comprehensively.

Police department point of view.

Local Community

The local community should actively participate in efforts to address the issue and remain vigilant of their surroundings.

Forest Department

We suggest that the Forest Department judiciously utilize their authority to take proactive measures to prevent human encroachment into natural habitats. They should work with the community to ensure sustainable use of resources and bring in regular monitoring and efficient alert systems to minimize negative interactions between animals and humans.

NGOs

The NGOs should become more decisive and assertive in implementing their programs with the local community. They should also actively collaborate with the Forest Department in training and equipping the Police Force to tackle situations of human-wildlife interactions.

Media

The significant role of journalists in mobilizing support and garnering attention is acknowledged. However, they must use their public reach to disseminate accurate information and contribute to the removal of myths and misinformation. They should portray the ground reality rather than building a negative image of the animal or any stakeholder involved. Journalists also have a crucial role in communicating the positive measures taken by the stakeholders in the affected area.

Journalists point of view.

Forest Department

Despite being understaffed, the Forest Department deserves appreciation for their immediate response and action in critical situations. However, their efforts often lack a foundation in scientific research, which is essential for sustainable outcomes.

Additionally, their approach tends to overlook the importance of engaging with and empowering local communities, a crucial element for long-term conservation success.

The Forest Department appears to be narrowly focused on 'protection' rather than embracing the broader and more dynamic concept of 'conservation'. Protection implies guarding species against immediate threats - such as poaching, habitat encroachment, or human-wildlife conflict - without necessarily addressing the underlying causes of these issues or ensuring long-term ecological balance. Conservation, on the other hand, entails a more holistic approach. It involves restoring habitats, promoting biodiversity, engaging local communities, and implementing sustainable practices that benefit both wildlife and human populations.

The Forest Department is often criticized for its slow pace in addressing critical issues, largely hindered by the bureaucratic cycle. Their response to the situation lacked the urgency it demanded, reflecting a reactive rather than proactive approach. To effectively tackle such challenges, they must streamline decision-making processes and adopt a more adaptive and dynamic strategy.

Another issue is the disbursement of the compensation, causing more opportunity and transaction costs making the issue more of a human-human conflict rather than a human-wildlife conflict.

Police

A significant issue with both the police and the Forest Department lies in their highly polished and carefully curated press releases, which journalists are often forced to rely upon. However, when we conduct on-ground verification, the reality frequently presents a completely different narrative. The lack of consistency and corroboration in the information provided by various stakeholders further complicates our work, making it challenging to uncover the truth.

NGOs

While many NGOs focus on conservation efforts with an emphasis on community involvement and addressing local needs, their methods are not always grounded in scientific research. Instead of rushing to utilize available funds, these organizations should prioritize thorough, evidence-based research, even though such an approach may not always be appealing to funders. This would ensure that conservation initiatives are both effective and sustainable in the long run.

Scientists

While scientists play a critical role through their focus on hard science and research, it is equally important for them to consider local communities as integral to the solution. Conservation efforts must recognize that human lives are just as valuable as the animal species they aim to protect. The ultimate goal of scientific work should extend beyond publications, striving for tangible, on-ground impact that balances ecological sustainability with the well-being of people.

Government

The government is often slow to mobilize unless there is an opportunity for recognition, which results in only short-term actions aimed at gaining attention, rather than implementing a long-term strategy to address the issue or prepare for future occurrences. This reactive approach leaves little room for sustainable solutions. Furthermore, there is a significant lack of coordination between different branches of government, which impedes the development of unified plans. Additionally, the process for releasing funds is notoriously slow, further hindering timely responses and effective action.

Government's point of view.

Police Department:

The government strongly criticized the police for their excessive use of violence, which escalated

tensions and created unnecessary chaos on the ground. Their reluctance to assist during the initial stages of the operation, driven by ego and a desire to assert dominance, was deemed unacceptable and counterproductive. Despite their eventual efforts to control the mob, their approach marred the operation's overall effectiveness.

Forest Department:

The government noted delays in decision-making and criticized the Forest Department for reacting only after the chaos erupted. Proactive measures could have prevented the situation from escalating. Although the department's efforts were eventually effective, their lack of foresight in addressing the root causes beforehand was highlighted as a major shortfall.

Media:

The media faced harsh criticism for sensationalizing the issue and using it to boost their public reach. By spreading misinformation, including false narratives about the Forest Department prioritizing wildlife over human safety, the media contributed to panic and mistrust among the public. The government emphasized the importance of media responsibility in such crises, urging them to adopt a neutral stance and focus on supporting public welfare and government efforts.

NGOs:

While NGOs played a crucial role in community awareness and operational support, their overemphasis on species protection at the expense of human concerns drew criticism. The government stressed the need for a balanced approach that considers both ecological and human priorities.

Scientific Community:

The government demanded an explanation from the scientific community for their apparent negligence in monitoring wolf populations and behaviour, which allowed the situation to spiral out of control. Their lack of preventive measures was identified as a significant contributor to the escalation. The government urged scientists to prioritize detailed studies on wildlife behaviour and ecological dynamics to prevent such crises in the future

RHATC Team involved

Villagers: Mohsin and Koshik
Forest Department: Sidharthan and Poojitha
Police: Priya and Ananditha
NGO: Diya and Shivangi
Journalists: Zeal and Himangshu
Government: Mohsin, Koshik, Sidharthan, Himangshu and Poojitha
Scientists: Zeal, Diya, Priya, Ananditha and Shivangi
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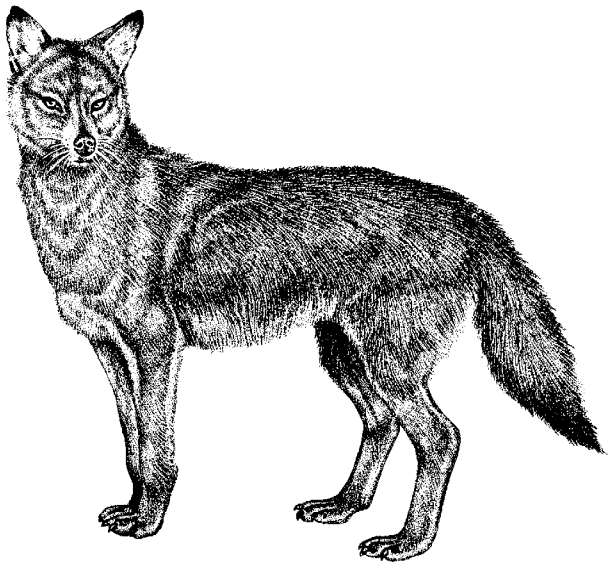

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Exploring the displayed insects at the Coimbatore Museum

As a part of our RHATC Course the ten fellows of the 4th batch had the opportunity to visit the 'Insect Museum' which is a part of the Department of Agricultural Entomology at Tamil Nadu Agricultural University, Coimbatore. The Insect Museum is a fascinating educational space dedicated to showcasing the incredible diversity, biology, and ecological importance of insects. The museum is a treasure trove for nature enthusiast, researchers, and anyone curious about the often overlooked world of insects. Before directly diving into the mind-blowing things which received us in the museum, we will try to understand something more about insects so that we could set a platform to discuss about the museum, its importance, and its implications in conservation.

About Insects

Class Insecta, is the most diverse group of invertebrate organisms which show cosmopolitan distribution all around the world and include organisms characterized by six legs, a three-part body (head, thorax, and abdomen), and an external skeleton made of chitin mostly.

The Insecta is classified based on different basis, the most common being based on their social structures. We have insects such as weaver ants, honeybees, paper wasps, and termites who live in organized colonies and cannot survive alone while others, like the coconut skipper, bagworm, gall insect, carpenter bee, antlion, and caddisfly lead solitary lives.

Insect Life Cycles

The life cycle of insects makes them very special among other invertebrates as they have a larval stage in most cases and undergo a special type of development which increases their complexity from egg to an adult individual. There are different types of metamorphosis based on the steps they undergo during development, they are:

1. Holometabolous (Complete metamorphosis)
2. Hemimetabolous (Incomplete metamorphosis)
3. Paurometabolous (Gradual metamorphosis)
4. Anamorphosis (No metamorphosis)

DIFFERENT ROLES OF INSECTS

Role as predators

Root feeders include predators like Arecanut root grub, root aphid, wireworm, sugar root scrub, and termites, which feed on plant roots. Stem borers such as the rice yellow stem borer, potato tuber moth, brinjal shoot borer, banana pseudo stem borer, sorghum stem borer, and cardamom shoot borer prefer plant stems. Leaf folders and rollers, including the rice leaf folder, mango leaf twisting weevil, banana skipper, rice case skipper, coconut leaf roller, and coconut skipper, feed on leaves by folding or rolling them. Leaf miners and gall makers, like the cashew leaf miner, groundnut leaf miner, serpentine leaf miner, citrus leaf miner, mango shoot gall, and eucalyptus leaf gall, feed on leaf tissues or induce galls. Defoliators such as the mango leaf weevil, mustard sawfly, brinjal

hadda beetle, grapevine flea beetle, coconut rhinoceros beetle, and leaf cutter bees strip plants of their foliage.

Flower feeders, including the blister beetle, jasmine bud worm, bean pod borer, gram pod borer, chafer beetle, and diamondback moth, prefer flowers and buds. Fruit borers like the mango nut weevil, tomato pinworm, pigeon pod borer, brinjal fruit borer, lablab pod borer, and guava fruit borer feed on developing fruits. Lastly, tree borers, including the cashew stem borer, bark borer, shot hole borer, Asian long-horned beetle, emerald ash borer, and sandalwood borer, bore into tree trunks and branches, which at times may cause structural damage to the plant. Apart from the variety of ecological services insects provide, in reality, their positive contribution to the agricultural sector overshadows the negative perception of their harm to agriculture. The predator-prey relationship between insects is important for maintaining balance in insect species and the ecosystem.

The insects play a very crucial role in the ecosystem as we will read now.

Role as Pollinator

Insects visit flowers to feed on nectar and pollen, and in the process, they may accidentally brush against the flower's reproductive parts. This transfers pollen from one flower to another, allowing the plant to fertilize and produce fruit, seeds, and new plants. Bees are the most important group of pollinators.

Role as decomposer

Insects physically break down large pieces of organic material into smaller fragments, which are then further decomposed by microorganisms. Insects like blowflies and flesh flies lay their eggs on dead animals, and the larvae feed on the soft tissues, speeding up the breakdown process and insects also improve soil structure by enhancing aeration and promoting nutrient availability.

Insects also serve various purposes across multiple industries due to their versatility and nutrient richness and are often exploited. As a sustainable protein source, they offer an alternative to traditional livestock and are used in feed ingredients for many species. In the textile industry, silkworms are cultivated for silk production. Cosmetics benefit from insect-derived pigments, essential oils, and fatty acids found in products like moisturizers, shampoos, and lipsticks. Agriculture relies on insects as natural pest controllers, pollinators, and contributors to soil quality through their waste, such as exuviae & frass, which enhance plant

Role of insects In pollination. © Diya Banerjee

Role of Insects in Agriculture. © Diya Banerjee

growth. Additionally, insects are widely used as fishing bait, while substances like antimicrobial peptides, apitoxins, and enzymes derived from insects play a role in medicine by combating infections, inflammation, and diseases like cancer. Historically, cochineal, a pigment from scale insects, was used by the Aztecs as a dye for textiles and body paint.

Insects in Stamps

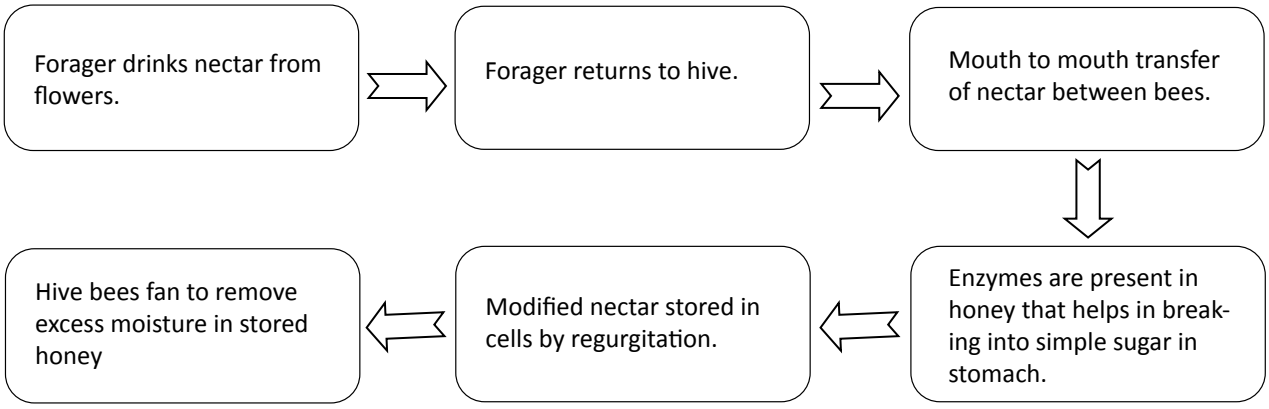
Another important fact about insects where they have been a part of philately for decades. The first stamp featuring an insect was issued by Nicaragua in 1891, depicting a honeybee hive. Since then, over 5,000 stamps featuring insects have been issued globally, celebrating their diversity and importance. This shows that human kind has recognized the services provided by the insects both to the ecosystem and to the humans and were ready to acknowledge all these in the very beginning of the human race.

The display of migration of insects was quite remarkable and extraordinary and served as a feast to our eyes. Moreover, this information was very new to most of us as it was a bit difficult to believe that such tiny creatures could travel such long distances. Some interesting stories of insect migration below.

Monarch Butterfly Migration

The monarch butterfly *Danaus plexippus* undertakes an extraordinary migration to escape the cold winters of the USA. Millions of butterflies travel 2,800 miles to central Mexico, completing the journey over four generations.

How bees make honey



Desert Locust Migration

The desert locust is one of the biggest predator invading 20% of the world's landmass.
Its invasion area spans 32 million square kilometers, while its recession area covers 16 million sq. km. A single swarm, consisting of 40–80 million winged adults or wingless nymphs per square kilometer, can migrate up to 100 km per day. During migration, a swarm consumes as much food as 10 elephants, 25 camels, or 2,500 people daily, causing devastating damage to vegetation.

As honey bee is one of the first and foremost thing which comes to our mind when we think about insects, let us try to understand a bit more about honey bees. To begin with, we will try to have an idea about their life cycle.

Life Cycle of a Bee:

A queen bee lays up to 2,000 eggs per day, and these eggs mature in about 21 days. The bee colony consists of a single queen, around 5% drones (males), and approximately 95% worker bees.

Honey, being an integral part of Indian diet in general, cannot be left back when discussing about bees. So, let us try to figure out how the bees produce honey.

Benefits of honey

Honey provide several health benefits, including:

- Regulation of blood sugar.
- Antibacterial properties.
- Relief from asthma.
- Enhanced athletic performance.
- Probiotic benefits.
- Antifungal properties.
- Reduction in ulcers and gastrointestinal disorders.
- Control of blood pressure.
- Anti-cancer properties.

Conclusion

Insect Museum was a place that holds vast knowledge, serving as a valuable resource for researchers while also offering entertainment to the public. However, as far as I am concerned, the museum is in pursuit of creating visually appealing displays to attract visitors, has collected some dead insects and preserved.

I also observed the perception of my fellow beings as they came from diverse science backgrounds, each bringing a unique perspective. Those with expertise in entomology were particularly precise, sharing detailed information about insects with the group. Some of them, curious about insects, were amazed by the incredible diversity they observed.

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RHATC On the Rocks: Experiencing the Uniqueness of Tumkur's Rocky Outcrops and Inselbergs

The second field trip of RHATC took us to the rocky outcrops of Tumkur, Karnataka. Unlike our first field trip, we had little time to anticipate what lay ahead. Nonetheless, the excitement of being on field to witness the landscape was undeniable, especially as the theme for RHATC 2024 is "Inselbergs and Rocky Outcrops".

The fellows had the privilege of interacting with a group of resource persons working on rocky outcrops in different parts of the country. These sessions provided a comprehensive understanding of the biodiversity, conservation challenges, and ecological importance of these unique ecosystems.

Prior to and during the field trip, we interacted with Dr Aparna Watve, a rocky outcrop specialist and member of the IUCN SSC Western Ghats Plant Specialist Group. Aparna has worked extensively on the flora of rocky outcrops in the northern Western Ghats. Her insights into the adaptations of plants in these ecosystems gave us a deeper appreciation for their resilience and ecological roles.

We also had the opportunity to learn from Sanjay Thakur, a wildlife conservationist who has worked in the central Indian landscape on human-leopard interactions, wildlife trade, and law enforcement with organizations such as WCT, WWF-India, and TRAFFIC-India. His experience in addressing human-wildlife interactions and illegal wildlife trade provided valuable lessons in conservation.

We also learnt from Dr. S.R. Ganesh who accompanied us on our trip to Tumkur, a herpetologist and research director at the Kalinga Foundation, who shared his knowledge of herpetofauna found on rocky outcrops. He is well-known for his work on the reptiles of southern India, including the discovery and re-description of several species. His sessions highlighted the importance of reptiles in rocky ecosystems, their behaviour and natural history.

During the trip, we were also joined by Dr. C. Srinivasulu and Dr. Bhargavi Srinivasulu, wildlife biologists and taxonomists from Osmania University, Hyderabad who have worked extensively on bats and reptiles in southern India. Their engaging discussions on taxonomy and conservation connected scientific knowledge with practical approaches for protecting biodiversity.

At Tumkur, we interacted with resource persons Sachin Gowda, Secretary of Wildlife Awareness and Reptile Conservation Organization, who is involved in education and outreach, snakebite mitigation. He also works on understanding the effects of urbanization on snake home ranges. Karthik Nayaka, a wildlife researcher and IBCN state coordinator for BNHS in Karnataka, who studies migration of river terns in Bhadra with BNHS was constantly helping sight different birds during our trails. S. Raghunandan, an independent researcher who focuses on the ethnobotany of the flora of southern India and

works with the research unit of the Karnataka Forest Department kept us intrigued with amazing information about the flora found on Devarayanadurga. This well-rounded understanding of rocky outcrops was built on the foundational knowledge we gained from our interactive discussions and classes with Sanjay Molur on the evolution of life on Earth, its biogeography, and how "rocks shape life and life shapes rocks".

Such a comprehensive knowledge-base, equipped us to understand rocky outcrops, their ecology, the biodiversity, and the conservation challenges they face, thereby helping us to learn and fully experience throughout the field trip at Tumkur.

27 DECEMBER 2024 – JOURNEY TO TUMKUR

On 27 December, we stood amidst the serene hues of dawn at 5:00 AM, ready with our luggage and loading the van. The sky gradually shifted from deep blue to lighter tones as we began our journey from Coimbatore. Travelling through forests and villages, our playlist evolved just like the changing shades of the sky.

Upon reaching the Karnataka Forest Checkpost, we paused for a bit of birdwatching with Srinivasulu. While we observed birds, an unexpected companion joined us—a dog, tagging along as though intrigued by our discussion about how stray dogs pose a threat to wildlife. The conversation eventually transitioned to taxonomy, where Srinivasulu

explained the nuances of scientific naming and binomial nomenclature.

After a brief tea break, we resumed our journey and finally arrived in Tumkur after 12 hours of travel with stops for eats, toilet breaks, and discussions. The guest house where we stayed – Eesha Farm House in Thimmanayakana Halli, Tumkur, just adjacent to Devarayanadurga Forest, was calm and beautiful, surrounded by rocky outcrops on all sides. Spotting the peaks of these outcrops sparked our excitement to climb them the next day.

After settling in and unpacking, we set out for a bit of bat detection later in the evening. Srinivasulu and Bhargavi introduced us to the intriguing behaviour of bats using bat echolocation sensors. We identified three bat species—*Pipistrellus ceylonicus*, *Pipistrellus tenuis*, and *Scotophilus* sp. Each species' unique frequency range helped us distinguish their calls, which could be categorized as either feeding or social calls. Social calls are used for communication, while feeding calls are heard when bats hunt.

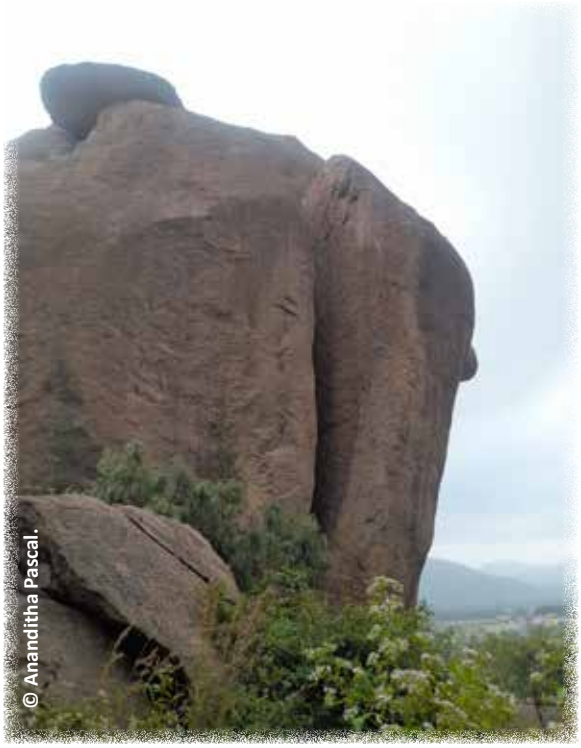
It was an unforgettable experience—learning under the dark, star-lit sky, surrounded by glowing fireflies, and gaining invaluable knowledge from two of our most inspiring mentors. All the fellows were highly motivated and excited to set out and explore such a unique landscape through the rest of the trip.

28 DECEMBER 2024 – A DAY OF SERENE AND CHAOTIC ENCOUNTERS WITH NATURE

We started the day with great excitement and enthusiasm for an early morning birding session on the rocky hill situated opposite our place of stay. Accompanied by Srinivasulu and Bhargavi, we soon reached the hill and began climbing upwards to explore the uniquely shaped rock structures present on the hill. We had a great time exploring these wonderful rock formations and discussing about the historic processes behind the evolution of such large rock boulders.

As we trekked further away, we got into the actual birding session, during which we spotted several birds including the Red-wattled Lapwing, the Rufous Treepie, the White-browed Bulbul, the Large Pied Wagtail, the Scaly-breasted Drongo, the Flameback Woodpecker, the White-throated Kingfisher, the Indian Robin, the Red-vented Bulbul, the Crimson-throated Barbet, and the Purple Sunbird. These wonderful sightings were also accompanied by the calls of the White-cheeked Barbet and flowerpeckers. On our way back, we spotted a raptor, whose call seemed like that of a Crested Serpent Eagle. It was such a majestic sight to see the bird scanning the ground, probably hunting or guarding its territory.

We soon returned to the farm house and after having a quick breakfast, we went to Devarayanadurga Peak Viewpoint through Jenugudu jungle trail. We were accompanied by Sanjay, Ganesh, the Srinivasulus, Trisa, Sachin, Karthik, and Raghunandan. At the beginning of the trail, we saw a group of Verditer Flycatchers *Eumyias thalassinus* and Indian White-eyes *Zosterops palpebrosus* flying freely and feeding. The team spent a good amount of time observing and photographing these beautiful birds. Additionally, we spotted a *Parus cinereus* and a Yellow-throated Bulbul *Pycnonotus xantholaemus*, a species endemic to the rocky regions of southern India.

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Further along the trail, Raghunandan showed us several medicinal plants. For instance, he introduced us to *Celastrus paniculatus*, a liana (woody climber) whose seed oil is used in Indian medicine. He also pointed out the *Apamarga* plant, whose seeds are utilized in Ayurveda for various health problems. Another interesting spotting was the *Aristolochia indica* climber, a host plant for the Common Rose *Pachliopta aristolochiae* and Southern Birdwing *Troides minos* butterflies.

A slight brush against the brown bristles of *Mucuna pruriens* seed pods made this experience unforgettable, as they cause itchiness. We also observed Western Ghats endemic plants like *Cipadessa baccifera*, whose seeds are consumed by bulbuls.

Further along the trail, we spotted the eggs of rock geckos in a rock crevice. As we trekked further we crossed by a spot where we found fresh leopard scat. The fellows were thrilled, especially for those who had seen it for the first time! It was just a matter of time and probability. Although we could suspect the possible paths the leopard had taken, we were probably already being watched by the leopard! As the team moved further up, we came across a beautiful landscape of exposed rock, shaped by millennia of weathering.

The team stopped to absorb the scenic view and appreciate the work of geographical evolution right in front of our eyes. We climbed further up where we stopped by the possible ruins of a shelter for cavalries of old armies. It was here that Ganesh and Srinivasulu spotted and chased after a very interesting gecko that appeared to be like a dark form of *Hemidactylus whitekari*. We stayed here for a while, clicking some photographs and resting, before heading back. As we started to go back, we saw a rock agama basking in the sun and headed back to the farm house.

During the night, we accompanied Ganesh for herping to the hill opposite our place of stay. The landscape appeared completely different under the cover of darkness.

During the herping session, we spotted several fascinating species, including *Hemidactylus giganteus*, *H. srikanthani*, *H. reticulatus*, and an unidentified gecko species. We also observed various species of moths. Additionally, we spotted a Green Vine Snake resting on tree branches.

While we were busy looking at the geckoes, we had an unexpected encounter with a Sloth

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Bear. The bear issued warning calls, which alerted us to its close proximity. Understanding the gravity of the situation, we quickly and calmly retreated to our stay without wasting any time. It was an exhilarating and memorable experience that showcased the vibrant nocturnal life of the region.

29 DECEMBER 2024 - AN ADVENTUROUS JOURNEY IN SEARCH OF BATS

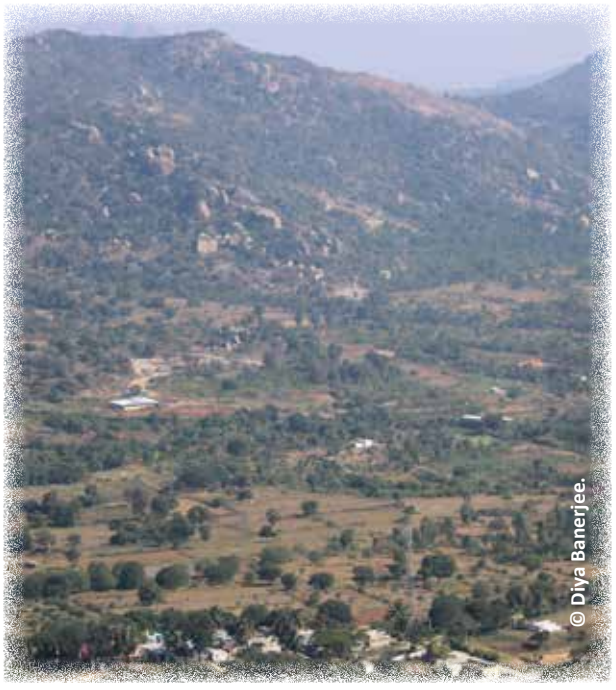
After a nerve-wrecking close encounter with a Sloth Bear the previous night, we mustered our courage and geared up for another adventure towards the same hill top—this time in search of bats. The local villagers shared an interesting piece of information that farmers in the area used to collect bat guano from the rocky caves of the hill to use as fertilizer for their crops.

Our day began early, at 7:00 AM, with Srinivasulu and Bhargavi. We were guided by Yogesh and Pavan, locals who were familiar with the landscape. Walking through the flat lands we reached the foothills from where the real trek unfolded. Without a previously cleared trail, the team had to find their own way to the bat cave at the hilltop with the guidance of Yogesh and Pavan. As we ascended, the vegetation transformed—starting with moist grass and shrubs at lower altitudes, gradually giving way to woody, thorny vegetation and bamboo shoots higher up. We moved carefully, helping each other during the steep climb up towards the hill top. As we reached higher elevations, the landscape changed dramatically.

The lush greenery gave way to withered, dry grasses, creating an environment highly prone to wildfires. The thought of such a disaster threatening the diverse flora and fauna made us acutely aware of the fragility of this ecosystem. Along the way, we stumbled upon claw marks etched into the soil—clear evidence of a bear's foraging activity. It was fascinating to imagine the strength and sharpness of its claws as it dug for tubers.

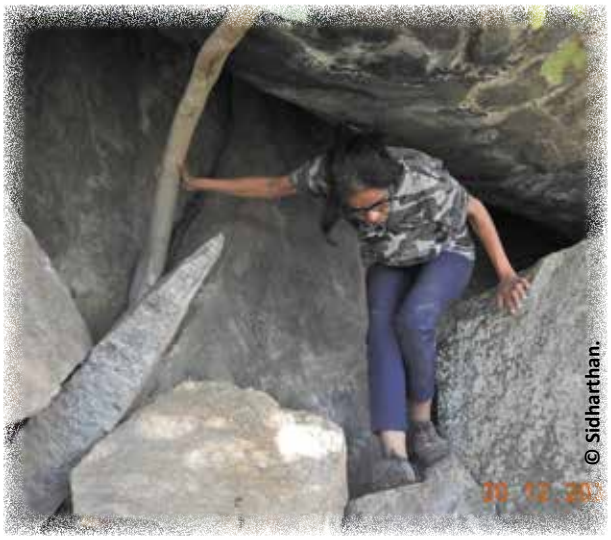
Finally, after a challenging climb, we arrived at the hilltop caves. Yogesh pointed out a small cave in the corner of the massive rock, mentioning that farmers collected guano from there. However, a quick inspection revealed no bats. Just as our hopes began to dwindle, Srinivasulu spotted a solitary bat, reigniting our enthusiasm. Encouraged, Pavan guided us to another crevice between two rocks. This time, as Srinivasulu and Bhargavi carefully examined the crevice, we spotted bats fluttering inside. Excitedly, we took out the bat echo detector to record the frequency of their echolocation calls. Though the bats were too far for us to see clearly, Srinivasulu and Bhargavi, with their expertise, identified them as Black-bearded Tomb Bats *Taphozous melanopogon*.

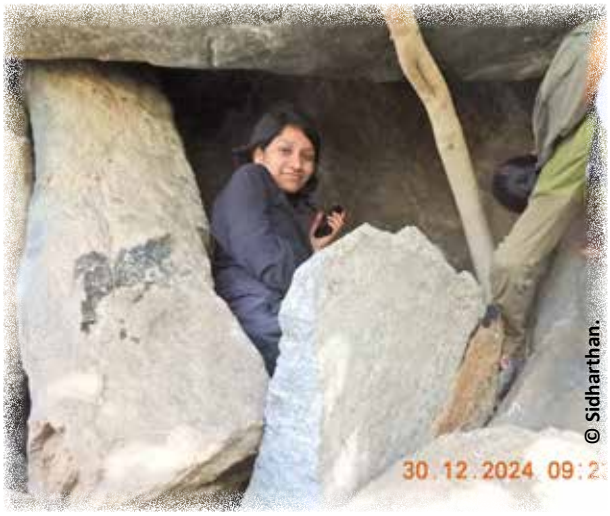
We observed their behaviour for a while, noting a larger, inaccessible crevice higher up the rock where more bats likely roosted. Satisfied with the trek up to these caves and witnessing these uniquely evolved tomb bats, we relaxed to enjoy the breath-taking scenery from the hilltop, soaking in the serene beauty of the landscape.



The descent proved even more challenging than the climb. With some careful trekking down, occasional slips, and plenty of teamwork, we finally reached the base by noon. Hungry and tired, we enjoyed a hearty meal before heading for a swim in a nearby waterhole.

There, we found local children joyfully playing in the water. Unable to resist, we joined them, cooling off and sharing in their laughter. As the evening set in, we concluded our day with a mesmerizing observation of fireflies, their behaviour and how light spill-over from the nearby village would affect these sensitive





insects. We were joined by Mr. Mathi, from Wild and Dark Earth, an organization involved in the research and conservation of fireflies in India. He was documenting the synchronous flashing behaviours of fireflies that light up every evening in the area where we were staying. We cherished these moments of connection with nature and each other.

The day was not just an adventure, a tough and satisfying climb up the hill, but also a core reminder of the ecological uniqueness that every ecosystem holds which requires every bit of equal effort towards protection and conservation.

30 DECEMBER 2024 - FROM TEMPLE TREKS TO GRASSLANDS

After days of thrilling yet challenging forest treks, our day began with an adventurous climb to a temple located on a hill top, followed by a visit to the Sloth Bear Wildlife Sanctuary in the afternoon, and concluded with a mesmerizing experience of blackbuck sightings in the evening. Throughout the day, Sanjay, Trisa and the fellows were accompanied by Sachin and Karthik, whose presence added to the excitement and camaraderie of our journey.

The day started as we boarded our traveller from our accommodation, heading towards Siddarabetta. A temple dedicated to the Hindu God Siddeshwara located at the top of Siddarabetta. Beyond this temple, several caves and rock structures are present. The group's excitement was palpable, and everyone's energy was at its peak when the team began to climb up the long stretch of stairs leading

to the temple. However, as we ascended the stairs of the temple, the initial enthusiasm gradually waned, prompting a much-needed halt for breakfast. Re-energized, we continued our climb, marvelling at the natural beauty surrounding us. The landscape was adorned with rocky outcrops hosting a mix of native and invasive plant species, creating a captivating spectacle.

Sparsely spaced trees with grasses found roots on the rocks or shallow soil. How did the roots of such huge trees manage their way into the rocks to be able to stand sturdily? If we had a way to look through the rock to witness the roots, it would've been so wonderful! What was distinct in the trees observed here was that they grew on bare boulders and not only crevices between rocks or shallow soil which was similar to the trees of the Rao Jodha desert rock park in Jodhpur, Rajasthan that one of us fellows had witnessed. In this context, one particular study requires a mention. This study conducted in southeastern Brazil analysed 30 specimens of two herbaceous plant species living on quartzite rocks — *Barbacenia tomentosa* and *B. macrantha*, both of the Velloziaceae family — and found specialized segments of densely packed hairs just behind the root tip. The roots were found to secrete malic and citric acids, likely from the fine hairs, that dissolve rock and release phosphates that the roots then absorb to acquire the nutrient phosphorus.

The same study also employed microscopy scans and found that the roots carve their own way into rocks, rather than growing along cracks (Teodoro et al. 2019). A similar adaptation could be employed by the several plant species that had managed to survive and grow on these

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bare rocks, including a wide canopied *Shorea* spp., a *Vitex altissima* tree which exhibited a unique woody trunk, a young *Adina cordifolia* and a *Sterculia colorata* tree with a glowing light brown trunk. What a learning experience it was to witness such wonderful species! As we ascended, we spotted a *Euphorbia* spp. growing in crevices between two rocks with an undergrowth of grasses. Soon, we reached a group of boulders forming beautiful caves and spaces. The team walked through these spaces to the other side, revealing to us a panorama of rocky outcrops, abundant grasses and occasional stunted trees in between. It was on this hill top here, that the team was privileged to witness the endangered Egyptian Vulture *Neophron percnopterus* soaring over the valleys. Dogs followed us from the beginning all the way to this point and we witnessed them chasing away the Bonnet Macaques, showing us the dangers that domesticated dogs present to wildlife.

Next, we journeyed to the Thimlapura Sloth Bear Sanctuary, where we were hosted with a refreshing lunch, after which we ventured into the forest. We were joined by Shivraj, the forest watcher, who guided us through this enchanting wilderness. Along the way, Shivraj shared fascinating insights about the local flora and their uses by humans. He pointed out plants like the Indian rosewood, mango ginger and told us about their usage. We learned about the medicinal properties of *Terminalia arjuna*, used to reduce blood pressure the mystical associations of the *Alstonia scholaris* (in Kannada called 'raktabati') often used in black magic rituals, and the *Gymnema sylvestre*, a creeper (in Kannada called 'madhunashini'),

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known for its diabetes-curing properties. We also saw a *Cassia fistula* tree, which is non-native, but is apparently a favourite among bears. Its bark aids in treating fractures in livestock. During our walk we also had the chance to snack on fruits of *Ziziphus mauritiana* (commonly called as 'ber'). We also saw *Ixora pavetta* also known as the Torchwood tree (in Kannada called 'goravi') whose sticks were used by the British as torchlights.

Along the way, we passed by ancient remnants of the British era, including a labour and kitchen house, as well as tanks that once served as drinking water sources for horses. We also had to fend off a surprise attack from ticks! A fact that fascinated us was that the trails we walked were not man-made but formed by the footsteps of Sambar Deer.

In the evening, we visited the Jayamangali (formerly Maidenahalli) Blackbuck Conservation Reserve, the only notified protected area in Tumkur district. Situated near the village of Maidenahalli in Madhugiri Taluk, this reserve is a 798 acre patch of grassland on the Deccan Plateau. It is bordered by Anantapur district in Andhra Pradesh and is home to Karnataka's largest contiguous population of blackbuck, apart from the Ranibennur Blackbuck Sanctuary.

We were awestruck by the sight of these graceful creatures, witnessing large herds of blackbuck sprinting across the grasslands with effortless elegance. Their beauty and agility left us in awe and as the day drew to a close,

we paused to soak in the breath-taking sunset, the sky painted in hues of orange and pink—a perfect ending to an unforgettable day.

31 January, 2025 - Breakfast with the CEO of TumkurZP.

On the last day of the year we left Eesha Farm House having spent four days filled with learning and adventure. The team had been invited by Prabhu G for a homely breakfast at his guest house. Prabhu G is an Indian Administrative Service (IAS) officer currently serving as the Chief Executive Officer (CEO) of the Zilla Panchayat in Tumkuru, Karnataka. In this capacity, he spearheads rural development and local governance initiatives, working to improve the lives of the district's residents through sustainable and impactful policies.

Beyond his administrative responsibilities, Prabhu G is deeply passionate about wildlife photography and nature conservation. His profound appreciation for the natural world is beautifully reflected in his photography, where he captures the intricate details of wildlife, the majesty of landscapes, and the rich diversity of India's ecosystems.

Upon arrival at his guest house, we were captivated by his extensive bookshelf filled with books on wildlife and conservation. His remarkable collection reflected his deep connection to nature. During our interaction, he enthusiastically shared his journey in wildlife photography, showcasing breathtaking photographs of elephants, tigers, leopards, and more. We were truly impressed by his extraordinary skills, his passion for wildlife, and his commitment to protecting and conserving natural habitats. We were impressed by his dedication towards the living world and the suggestions he gave us to improve our journey towards conserving species.

1 January 2025 - Returning home

The first day of the year 2025 was the last day of RHATC's second field trip. After a refreshing breakfast at Sanjay's parents' house in Bangalore, we set off to Coimbatore. On the Mysore-Bangalore highway, we drove past the rocky Ramnagara Hills, where iconic scenes from the movie "Sholay" were shot. The fellows marvelled at these towering inselbergs and rocky landscapes along the highway.

Our vehicles slowed down as Sanjay shared insights about the uniqueness of these ecosystems in the region. He spoke of the specialized species found here such as the *Hemidactylus* and *Cnemaspis geckos*, which have evolved through millennia on the unique

rocky outcrop landscapes. However, due to anthropogenic pressures several ecological changes have occurred, including a change in the vegetation patterns of the area. Additionally, we also witnessed the extensive mining and infrastructure development, including the highway's expansion, indicating a significant loss of habitat in these areas.

Later in the evening, as we travelled through the Sathyamangalam Tiger Reserve, where we were thrilled to spot elephants and a gaur, adding an unforgettable touch to our journey. After more than 12 hours of travel, we finally arrived home, bringing this enriching field trip to a close after a momo break at the Tibetan Camp at Odeyarpalya village in Karnataka.

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ACKNOWLEDGEMENTS:

The success of RHATC's second field trip would not have been possible without the generous contributions, and hospitality of many individuals and organizations. We are thankful to Eesha Farm House for providing us with a comfortable stay and serving delicious, homely meals that kept us energized throughout our journey. We are also thankful to the Thimlapura Sloth Bear Sanctuary and the Jayamangali Blackbuck Conservation Reserve for hosting us and granting us the opportunity to witness the unique biodiversity of their areas. Our sincere thanks also go to Sachin and Karthik for their hospitality, for guiding us to various significant sites, and for accompanying us throughout our travels in Tumkur.

Finally, we owe our heartfelt gratitude to Sanjay Molur (his parents and sister for putting us up on the new years eve and feeding us) and the Zoo Outreach Organisation team for meticulously planning and organizing this unforgettable field trip. Their care and guidance ensured an enriching experience filled with invaluable learning opportunities that we will always cherish.

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Anaikatti: To build or not to build?

Introduction

This document aims to demonstrate a way of thinking ecologically when introduced with an alluring promise of sustainable development whether in the form of townships, roads, or other projects.

A recurring question arises: how much development is enough and can it be done ecologically? Here, we aim to address these questions by shifting the focus from anthropocentric to an ecological point of view. Often economy is prioritised over ecology. They are perceived as being at odds with each other operating in separate silos. But can they be separated? This document explores these questions, grounding the discussion in science to uncover the answers.

Process

The strength of collaboration and the value of diverse perspectives were once again demonstrated during our task as RHATC fellows. We began with formulating a plan to establish a township in Anaikatti, a village located on the highway between Coimbatore (Tamil Nadu) and Palakkad (Kerala), we initially approached the challenge with a sense of trepidation. The area's unique location between Anaikatti South and North Reserve Forests heightened the complexity of human development with environmental conservation.

Our team, enriched by its varied expertise, quickly realized the advantage of having an architect among us. With Zeal stepping up to lead the group, we divided responsibilities and began formulating a comprehensive plan. By conducting a literature review, we identified existing human settlements, undisturbed forested areas, potential construction sites, and the necessary infrastructural developments. Our initial plan sought to balance human needs and wildlife conservation, incorporating strategies such as marking areas for wildlife corridors, especially considering the presence of the elephant corridor and other biodiversity.

However, our human-centric approach fell short of understanding of ecology. We overlooked critical issues such as waste management and the far-reaching implications of constructing a township within a forested region. Sanjay Molur aptly pointed out that our plan, under the guise of sustainable development, would inadvertently lead to significant environmental destruction. His guidance challenged us to shift our perspective from mere planners to conservationists, using our skills to assess and mitigate environmental damage rather than contribute to it.

This eye-opener prompted us to rewire our approach. Through an extensive review of case studies and literature, we identified the long-term consequences of similar developments, both for human inhabitants and the surrounding ecosystem. We recognized that unchecked urbanization in sensitive areas like the Western Ghats has historically led to devastating outcomes for both people and wildlife. This realization inspired us to explore alternative

approaches to conservation, emphasizing public awareness about the critical role that ecology plays in sustaining life and the irreversible consequences of disturbing biodiversity.

This report presents our findings and recommendations, not as a plan to build a township but as a case for protecting Anaikatti's ecological integrity. It highlights the importance of fostering coexistence by preserving forest ecosystems and demonstrates how informed decisions can benefit both nature and humanity in the long run.

Anaikatti: Introduction

The terrain is characterized by undulating landscapes with seasonal waterfalls and serves as the watershed for the River Bhavani. The altitude varies between 560 meters and 1,600 meters. The climate is semi-arid, as the region lies in the rain shadow area of the southern Western Ghats. It is primarily composed of southern dry mixed deciduous forests (Anitha et al. 2010).

Ecoregions

As per Anitha et al. (2010), the west coast tropical semi-evergreen forests are found in relatively undisturbed regions at altitudes ranging from 950 to 1,500 meters. These forests are characterized by high humidity, cooler temperatures, a sparse shrub layer, fewer forest gaps, and thick leaf litter. The area is geographically marked by steep slopes and mountain folds, and it serves as the catchment for major rivulets.

• Southern moist deciduous forests are located at altitudes between 800 and 950 meters, while southern dry mixed deciduous forests are found at altitudes ranging from 700 to 800 meters.
• Dry deciduous scrub and thorny scrub are situated at lower altitudes and experience significant levels of disturbance.

Soil composition

Anaikatti Hills consists largely of rocks of archaean origin. In most parts soil comprises hard gravel and in some places it is red loamy. In plains, soil is reddish-brown, clayey and is generally devoid of humus (Anitha et al. 2010).

Should new human settlements expand into Anaikatti or not?

Context:

In 2010, the world had 3.92 Gha of tree cover extending over 30% of its land area of which 28.3 Mha tree cover was lost by 2023. India had 31.3 Mha of natural forest recorded in 2010, extending over 11% of its land area and 134 Kha of natural forest was lost by 2023. From 2013–23, 95% of tree cover loss in India occurred within natural forest as per Global Forest Watch data.

The Western Ghats, which comprises of Anaikatti, is one of the four biodiversity hotspots in India. It has lost nearly 50 percent of forest cover since the early 1900s and the trend continues (Molur et al. 2011). Compared to the other hotspots, it has the highest human population per unit area >300 human/sq.km., making it that much more challenging to conserve (Molur 2009). This calls for all of us to collectively protect and conserve what we have left from further active exploitation than finding out alternative "sustainable" ways of development.

What does all this loss mean for us humans? It means economic, livelihood losses, and health crisis in addition to ecological losses. Ecological losses are intrinsically linked to economic losses, hence, it is essential to study the correlation.

Land Use and Land Cover (LULC) changes

LULC changes are among the most pressing environmental concerns due to their profound negative impacts on ecology, climate, water resources, soil health, and ecosystem services. These changes not only drive climate change at local, regional, and global scales but also have significant implications for human health, the resilience of natural ecosystems, and the sustainability of human societies. In ecologically rich regions like Western Ghats, human settlements and associated land use changes have emerged as major drivers of environmental degradation.

Drivers of LULC change and its impacts: Agricultural Plantations

Change in LULC patterns and its impact on various part of western ghats are good indicators to assess if the extent of change is alarming or not.

Like many tropical regions, the Western Ghats are undergoing rapid land-use changes, with forest lands increasingly transformed into agricultural areas and monoculture plantations. Additional factors, such as encroachment, hydroelectric projects, mining and the extraction of forest products, have further altered the landscape. Between 1920 and 1990, the deforestation rate in the Western Ghats was estimated at 0.57% annually (Menon & Bawa 1997; Jha et al. 2000; Kumar et al. 2010).

Significant portions of the Western Ghats have been converted for the cultivation of tea, coffee, rubber, and palm, as well as for livestock grazing. Commercial plantations, such as coffee, were introduced around the mid 1850s, replacing traditional crops like paddy. Tea and rubber plantations were initially established on an experimental basis in the early nineteenth century, followed by the expansion of coffee and palm plantations. As a result, evergreen forests, which were the predominant landscape, have largely been replaced by monoculture agricultural plantations. The extent of land covered by grasslands, agricultural plantations, urban areas, and mining operations increased notably, with their proportions rising from 2.73%, 28.26%, 0.37%, and 0.03% to 3.76%, 36.38%, 1.79%, and 0.06%, respectively (Ravishankar & Nagaraja 2020).

The spatio-temporal land use analyses decline of evergreen forest in Kodagu district from 40.47% to 27.14% primarily due to uncontrolled expansion of coffee plantations followed by built areas and other land-use changes. Coffee, rubber and other horticulture varieties cover 37% of the district (Ramachandra et al. 2019). The global trade of these crops influences the land-use demands, with significant consequences for local ecosystems (Meyfroidt & Lambin 2009). Jha et al. (2000) highlights that significant deforestation and land-use changes occurred in the southern Western Ghats between 1973 and 1995. It reveals a 25.6% loss of forest cover (2,729 km^2) over 22 years. Dense forests have declined by 19.5%, while open forests have shrunk by 33.2%, leading to a 26.64% increase in degraded forest areas. Districts like Coimbatore and Palakkad

experience the highest deforestation rates, with an alarming annual loss rate of 1.16% majorly driven by agricultural expansion and plantation development. Coimbatore district which includes the Anaikatti region lost 275 km² of dense forest and 441 km² of open forest, while degraded forest increased by 613 km². Evidently, agricultural plantations are the most significant contributors to the loss of forests in Western Ghats. Township expansion into Anaikatti would further add to the already alarming loss of forest cover.

While these plantations provide short-term economic benefits, they come at the cost of long-term ecological and economic stability. In some areas of the Western Ghats, these land-use changes have been associated with an increase in climate extreme events.

Linear infrastructures

Studies have shown how infrastructure projects, particularly linear infrastructure like roads, railways, power transmission lines, canals, and pipelines, affect forests. Linear infrastructures causes habitat fragmentation that disrupts ecosystem functions, alters wildlife migration patterns, and increases mortality rates from poaching and roadkill (Laurance et al. 2014; Woodroffe et al. 2005). According to Mongabay India, researchers found that such infrastructure developments have resulted in a 6% increase in small forest patches and a 71.5% decrease in large forest patches (more than 10,000 km^2). Fragmented forests result in smaller, more isolated habitats, limiting wildlife movement, particularly for large cats, and increasing extinction risks. Wildlife populations isolated by road-related fragmentation may experience long-term declines due to decreased gene flow and habitat availability (Riley et al. 2006). In India, roads have severely disrupted the movement pathways of elephants, hoolock gibbons, and rhinoceroses, particularly in central India's tiger conservation landscape, which is divided by over 4,300 km of highways (Choudhury 1987; Joshi & Singh 2007; Gubbi et al. 2012). For example, highways built through protected tiger reserves in India have resulted in frequent vehicular collisions with endangered species such as the Bengal Tiger (Carter et al. 2012). In Karnataka and Assam, elephant corridor fragmentation has increased crop raids and human fatalities, emphasising such developments have both ecological and human costs (Sukumar 2006). According to a recent study, human-wildlife overlap will increase across 57% of Earth's terrestrial surface by 2070, particularly in densely populated areas such as India and China (Hansen et al. 2020).

This expansion will increase pressure on natural habitats, making them global hotspots for human-wildlife conflict according to University of Michigan (2023). The Wildlife Conservation Trust (WCT) recorded death of 49 elephants on the railways in 2016–2018 (Bhatkhande 2023) and seven tigers killed by linear infrastructure in 2023 (Ghai 2023). These statistics highlight the deadly consequences of linear infrastructure encroaching on wildlife habitats. Species richness and abundance decline significantly at certain distances from roads (Boarman & Sazaki 2006; Coffin 2007; Ament et al. 2008; Bissonette & Rosa 2009). Furthermore, fragmented and isolated patches act as hotspots for zoonotic diseases like Ebola, Kyasanur Forest Disease (KFD), and Covid-19 (Rulli et al. 2017, 2021;

White 2020; Loiseau 2022). Roads serve as key pathways for invasive and non-native species to establish themselves in forest ecosystems. Changes in light availability and soil conditions along roads promote the growth of invasive species, which outcompete native flora and disrupt ecological balance (Meunier & Lavoie 2012; Godfrey 2015). Research indicates that the intensity and extent of forest fires are influenced by factors such as infrastructure (e.g., roads, pathways, and settlements), topography (Oliveira et al. 2012; Sachdeva et al. 2018), prolonged dry spells, high temperatures, reduced rainfall, and low humidity (Singh & Mal 2014; Jolly et al. 2015). Additionally, climatic phenomena like El Niño and La Niña (Mason et al. 2017), as well as lightning (Li et al. 2020), have significant effects on local, regional, and global fire patterns.

LULC change: Driver of Climate Change and Economy

In the Nilgiris, where deforestation and population growth are among the fastest in the Western Ghats, the consequences of land-use changes are particularly severe (Lakshumanan et al. 2012). Large-scale forest clearing for urbanization and commercial plantations has drastically reduced groundwater recharge and increased surface runoff. Built-up areas, dominated by impervious surfaces such as roads and buildings, exhibit the highest levels of surface runoff, reducing soil infiltration and heightening the risk of landslides and floods (Gregory 2006). The absence of a healthy and controlled sand-mining policy has led to the formation of artificial islands in riverbeds and dense jungle growth with large trees on these islands, causing significant blockages in river cross-sections. Encroachments and unscientific

constructions in the catchment areas of dams and high ranges resulting in loss of forest cover have further amplified the extent of damage during natural disasters. For instance, in 2005, a landslide destroyed the Government College in Idukki, which was reconstructed without conducting an environmental impact assessment (Hunt et al. 2020). The impacts of these changes are not limited to hydrology alone. It also drives soil loss, with erosion rates in the region steadily increasing over the past three decades. Chinnasamy & Honap (2023) reported that between 1990 and 2020, average soil loss rose from 32.3 tons per hectare per year to 62.7 tons per hectare per year, marking a 94% increase in soil erosion rates. Such high rates translate into a significant loss in the fertile top-soil, thereby making agriculture unfavourable.

An amphibian biologist K.V. Gururaja observed that in Karnataka, agricultural setbacks due to impacts of LULC like failing cardamom crops have driven farmers to sell their agricultural lands which were previously forests into tourism ventures. High soil erosion rates, accompanied by concentrated rainfall events are also contributing to erosion in downstream areas and increasing the soil sedimentation in rivers (Chinnasamy & Honap 2023). This threatens downstream human settlements with sudden flood events and has severe ecological impacts which is intrinsically linked to economic stability of our country. This demonstrates that the health of terrestrial ecosystems affects the freshwater ecosystems. All the ecosystems are intrinsically interlinked.

Efforts have been made to estimate the annual value of both direct and indirect services provided by wetlands worldwide, yielding varied results. The Millennium Ecosystem Assessment (MEA 2005) estimates that the total value of goods and services from global inland waters could reach up to USD 15 trillion. In contrast, another study places this value at approximately USD 70 billion (Schuyt & Brander 2004). Tropical inland fisheries, which include those in India, are valued at USD 5.58 billion annually (Neil & Bene 2008). In India, inland fisheries employ 5.5 million people, with women comprising 72% of the workforce (Dugan et al. 2010). This clearly indicates the correlation between loss of healthy freshwater ecosystems, i.e., ecology translates to loss of livelihoods and food security, i.e., economy.

The Western Ghats provide significant climate resilience to southern India. However, as the soil quality deteriorates, and natural vegetation is lost, the resilience of the forest ecosystems is reduced. In the Annamalai Hills, for example, establishment of plantations have made natural habitats highly heterogenic, leading to an increase in wildlife species richness compared to undisturbed forests. However, this disturbance fosters higher parasite diversity in wild animals, with eight parasite taxa recorded exclusively in disturbed plantation areas (Chakraborty et al. 2019). These findings underscore how human-driven changes create conditions that alter the ecological balance, often with unforeseen consequences.

Climate change compounds these impacts by altering rainfall patterns and intensifying extreme weather events. The Cauvery

basin water bodies have also experienced a considerable decline, primarily due to encroachments and reduced environmental flows (Ravishankar & Nagaraja 2020). In the Bharathapuzha and Varrar river basins, reduced rainfall has decreased annual runoff by up to 106 mm in upper and middle regions, while the frequency of dry and very dry years has increased by 21% (Chandu et al. 2022). Raman (2023) states that erratic monsoon rains, driven by climate change, combined with decades of deforestation like the unchecked rise of homestays and resorts in regions, have created conditions ripe for landslides and flash floods.

The devastating 2018 landslides in Kerala, which claimed over 400 lives and affected millions, serve as a stark warning. LULC change driven by an increasing human population is a primary cause for the increase of forest fires which is then intensified by climate change. Both primary and secondary forest systems face significant threats (Parashar & Biswas 2003; Cobb & Metz 2017). India, which holds just 1% of the world's primary forests defined as native, natural and undisturbed forests, is the second most vulnerable country to forest fires in South Asia (Reddy et al. 2019). The occurrence of intense forest fires has surged tenfold, with a 52% increase over the past two decades (Mohanty & Mithal 2022). Approximately 36% of India's forest cover is classified as fire-prone (ISFR 2019), with 65% of its deciduous forests particularly susceptible to fires, causing an estimated annual economic loss of USD 104 million (Ashutosh et al. 2019). Forest fires also adversely affect human health, as studies indicate a clear correlation between reduced anthrax outbreaks in humans and increasing distances from forest fire hotspots (Sagar et al. 2024).

It is worth noting that, climate change and land-use and land-cover (LULC) changes are deeply interconnected and often work in a feedback loop, creating a cycle that intensifies environmental degradation. This feedback loop is particularly dangerous because the effects of each process reinforce the other. For example, the conversion of forests to agricultural land or urban areas contributes to the warming of the climate (through the release of carbon and the reduction of carbon sequestration), which in turn worsens conditions like drought, flooding, and temperature extremes.

LULC Change: Human Wildlife interactions

Human-wildlife interactions become severe by the rapid expansion of human settlements into forested areas, which is primarily caused by habitat fragmentation, deforestation, and increase in human-wildlife proximity (Treves & Karanth 2003). These negative interactions are especially common in areas where human settlements and infrastructure encroach on forest habitats, increasing interactions between wildlife and humans (Woodroffe et al. 2005). Such interactions often result in serious consequences, including financial losses, human injuries, and deaths. For example, human settlements near forests in India have disrupted elephant corridors, resulting in crop raiding and human casualties (Sukumar 2006). The forced movement of wildlife into human-occupied areas in search of resources such as food and water increases conflicts and frequently results in retaliatory killings of animals (Fahrig 2003; Distefano 2005). Similarly,

urban settlements near forests worsen human-wildlife interactions by allowing opportunistic species like leopards and monkeys to exploit human resources, resulting in property damage and attacks (Athreya et al. 2013). Rivers and water bodies used by humans and animals become competition zones, especially during dry seasons, disrupting wildlife behaviour and imposing financial losses on local communities (Graham et al. 2010).

Arikomban – A case study on implications of human settlement expansion on human-wildlife interactions

The Booluvampatti-Attapadi elephant corridor, also known as the Anaikatti corridor, is located between 11.0833–11.1167 N and 76.7667–76.8000 E in the western region of Coimbatore District. It is bordered to the north by Gobanari RF, to the south by Thadagam RF, to the east by human settlements in Veerapandi Village, and to the west by the Anaikatti group of villages. The Booluvampatti-Attapadi corridor is extensively used by 50–75 elephants during their annual seasonal migration. It supports over 50% of the elephant food species within its overall vegetation. Additionally, this corridor is connected to the Silent Valley National Park in Kerala and the Kallar-Gandhapallam corridor (Ramakrishnan & Ramkumar 2007).

The major land use changes in this area include civil constructions, brick industries, and the conversion of private barren lands into agricultural fields. These activities have led to the narrowing of the corridor at several points, which were extensively used by elephants until recently. As a result, elephants are now forced to move into nearby agricultural lands and human settlements, causing increased crop damage and economic losses for farmers (Ramakrishnan & Ramkumar 2007).

The case of Arikomban highlights the consequences of habitat loss on human-wildlife interactions. Expansion of human settlements and infrastructure will likely increase human-elephant interactions and such interactions may escalate conflicts, prompting translocation or culling measures, which disrupt elephant movement and compromise their survival.

Attempts to translocate elephants from such corridors, as seen in previous cases like Arikomban in Kerala, are costly and largely ineffective. Arikomban's relocation required INR 15.85 lakh and over 150 personnel, only for the elephant to be recaptured after it moved into neighboring areas, creating further conflicts. Similarly, translocated elephants like Thanneer and Belur Makhna often return to their original ranges, resulting in repeated interactions with humans, fatalities, and escalated costs. These operations also impose significant disruptions on local communities, with curfews, school closures, and heightened stress during elephant capture and release efforts (Kedlaya 2024).

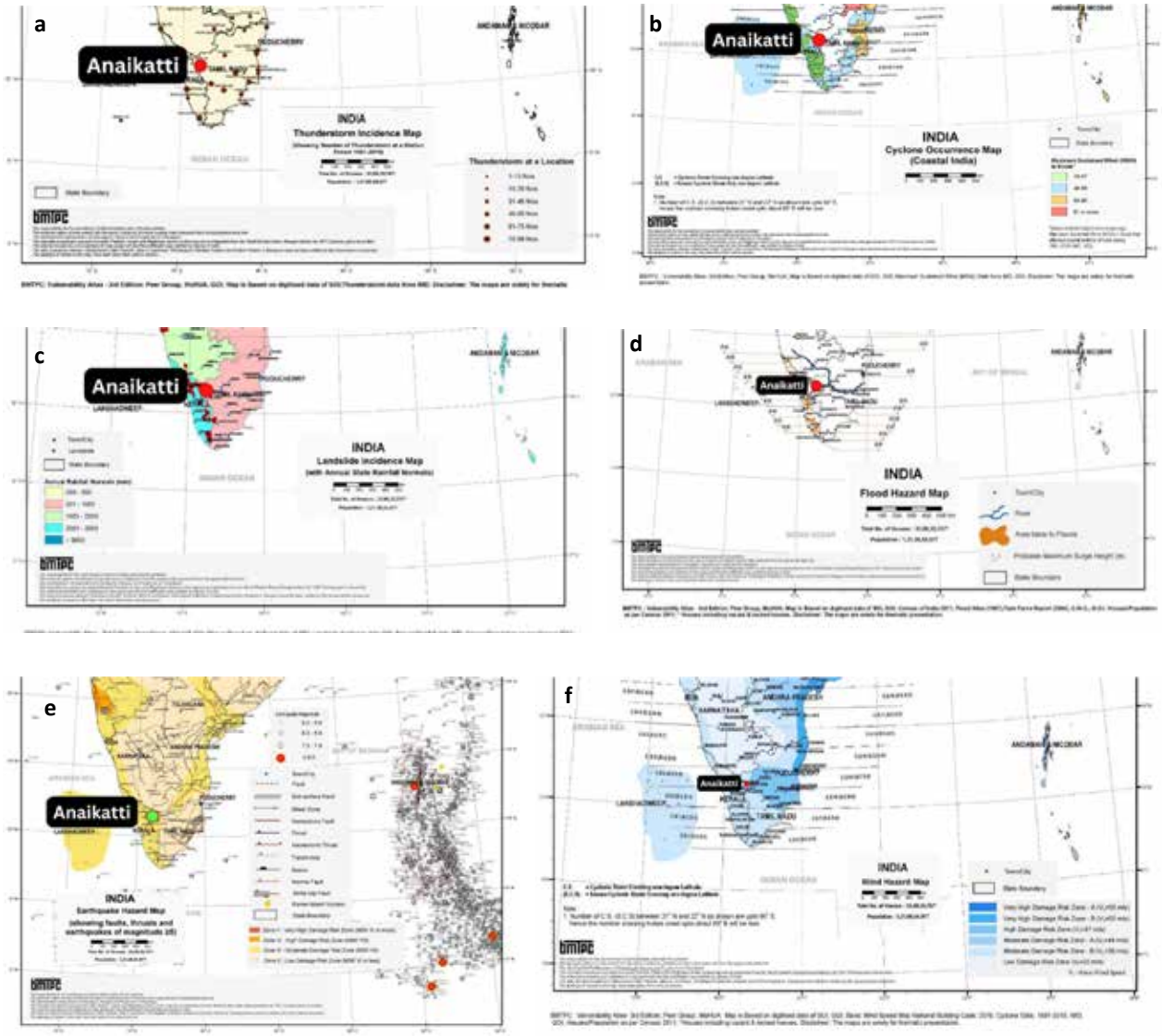
Past translocations across southern India show that relocating elephants doesn't solve the problem—it simply shifts it elsewhere. In the case of Arikomban, the bull elephant was moved from Chinnakkanal in Kerala to the Periyar Tiger Reserve. However, since wildlife doesn't recognize borders, the elephant ended up causing issues in nearby areas of Tamil Nadu. This forced Tamil Nadu to spend time and resources to capture and relocate the elephant again to another area within the

state. Clearly, translocation doesn't resolve the conflict but merely moves it from one place to another. There are chances of the translocated animals coming back to their original habitat, especially in case of elephants. And we have several examples of the same. The case of Arikomban serves as a powerful example of the consequences of habitat destruction and human-wildlife conflict. Developing a township in the Anaikatti area, which forms part of the elephant corridor, will undoubtedly worsen the existing human-elephant negative interactions in the region. The expansion of human settlements and population is likely to intensify these interactions further. Moving forward with the township plan would be highly detrimental, as it could eventually force the government to make difficult choices between protecting human lives and conserving wildlife.

Building a township in the Anaikatti area will shrink the natural spaces between humans and wildlife. This closer contact can lead to more interactions between people, livestock, and wild animals, increasing the chances of diseases spreading from animals to humans. These changes in the environment can make it easier for diseases to spread, raising the risk of outbreaks that affect human health.

Lavasa – a case study on range of conflicts due to introduction of a township

The Lavasa project, inspired by an Italian city, Portofino, led by Ajit Gulabchand. It is India's first privately developed city, located a four-hour drive from Mumbai. Lavasa was granted Special Planning Authority (SPA) status in 2007, Lavasa Corporation controlled essential services like power, water, and waste management. However, allegations of power misuse by the corporation led to the revocation of SPA status in May 2017 after numerous resident complaints about governance issues.



Map: |a|– Thunderstorm, |b|– Cyclone occurrence, |c|– Landslide incidence, |d|– Flood, |e|– Earthquake and |f|– Wind.

An investigation by the Ministry of Environment and Forests revealed that the Lavasa project caused environmental damage in the ecologically sensitive Western Ghats, a UNESCO World Heritage site. The construction proceeded without necessary environmental clearances, violating the Environment (Protection) Act, 1986. On June 10, 2011, the Union Environment Ministry directed the Maharashtra Government to act against Lavasa Corporation. Subsequently, Environment Minister Sanjay Devtale, initiated preparations to file legal action against the corporation. Ministry of Environment and Forests found Lavasa to be violating the rules and regulations under the Environment protection act 1986. According to MOEF, LCL (Lavasa Corporation Ltd) is in violation of The EIA Notification, 1994; the EIA Notification, as amended in 2004; and the EIA Notification of 2006.

The article "The Invisible Victims of an Unfinished City" by Mayank Aggarwal on Mongabay highlights several issues faced by the

people affected by the Lavasa project. Villagers from areas like Dudhwan, whose land was acquired for the project, struggle with basic amenities such as roads and drinking water. Many villagers were displaced, and their land was taken without adequate compensation. The Lavasa Corporation faced numerous legal challenges and financial issues, leading to the project's abandonment and leaving the area as a ghost town. The affected villagers feel neglected by the administration and politicians, who do not address their needs due to their small population.

The Lavasa project, as explained by Suniti S.R. of the National Alliance of People's Movement, had a significant impact on hundreds of farmers and tribal people in the area. A total of 1.08 TMC of water was allotted to Lavasa for their Lake City Project, even during a drinking water shortage in Pune. The Varasgaon Dam, a significant source of water supply for Pune City dried up during the hot summer months leading up to the monsoon, causing concerns about water availability. There were allegations that water from the dam had been diverted to Lavasa, a planned hill city, which raised fears of potential disruptions in Pune's water supply.

Farmers lost fertile agricultural land, which was leased to Lavasa for 'public purpose'. Many farmers' lands were taken fraudulently, and there were numerous environmental irregularities. Lavasa's special planning authority was cancelled due to violations of town planning and environmental laws.

The case of Lavasa brings about the conflicts that occur at different scales like conflict between Pune and Lavasa due to diversion of water, corporations and environment minister, locals and the township that eventually leads to loss of economy and ecology of an eco-sensitive zone.

Natural Disaster: study on Anaikatti

According to the wind hazard map, Anaikatti remains in the "48–63 zone" on a maximum sustained map indicates consistent exposure to sustained values within this range, often associated with moderate intensity for parameters like wind speed or rainfall, posing a threat to infrastructure and human safety. Also, it lies in close proximity to areas that are prone to flooding, further exacerbating the vulnerability of any proposed development.

The region is also categorized under moderate damage risk zone (MSK VII) for seismic activity, which increases the risk of structural damage during earthquakes. The area experiences an annual rainfall ranges 501–1,000 mm, which contributes to the already heightened risk of flooding and landslides. Furthermore, Anaikatti is situated near landslide-prone zones, making it particularly vulnerable to soil erosion and mass wasting, especially during intense rainfall events.

Given these environmental challenges, building a township in Anaikatti would not only jeopardize the safety of the people living there but also lead to the destruction of vital forest cover that plays a crucial role in stabilizing the ecosystem. The land, which supports both human and animal life, needs to be preserved to protect the community and the unique biodiversity of the region. Instead of pursuing urban development, we must focus on safeguarding this land to ensure the well-being of both the residents and the surrounding wildlife.

Biodiversity loss: impacts on ecology and humans

In the Western Ghats, amphibians exhibit the highest level of endemicity at 78%, followed by reptiles at 62%, fish at 53%, plants at 34%, mammals at 12%, and birds at 4% (CEPF 2007; Kumar et al; Nameer et al. 2001; 2002; Molur 2008).The endemicity percentage highlights the critical importance of conserving the rich biodiversity of the Western Ghats. It underscores the need to raise awareness among people about the unique species and ecosystems surrounding them and the vital role they play in sustaining life. A decline in biodiversity will inevitably have far-reaching consequences, directly impacting the lives and livelihoods of the communities that depend on these ecosystems. Therefore, preserving biodiversity is not just an environmental responsibility but a necessity for human well-being and sustainability.

Amphibians

Amphibians exhibit unique traits that make them particularly vulnerable to environmental disruptions compared to other wildlife (Rowe et al. 2003). These characteristics provide valuable insights into ecological processes and the impact of human-induced changes on the environment (Hopkins et al. 2007). Research on amphibian-chytrid interactions has advanced understanding of disease ecology and raised critical concerns about the emergence of diseases affecting both wildlife and humans (Daszak et al. 2001, 2003).

Reptiles

Reptiles, such as Varanids in Australia, Asia, and Africa, function as scavengers by consuming carrion (Shine & Harlow 1998; Dalhuijsen et al.

2015). They help remove flesh from carcasses, reducing disease spread and enhancing energy flow in trophic cascades. While squamate reptiles exhibit high cropping rates (Natusch et al. 2016), several species have gone extinct, including *Varanus priscus*, eliminated in Sahul during human colonization (Molnar 2004). Similarly, the matsoiid snake family, represented by the five-meter-long *Wonambi naracoortensis* and other large species like *W. barriei* and *Yurlunggur camfieldensis*, vanished after aboriginal settlement (Flannery 2002).

The Nile crocodile scavenges ungulate carcasses during river crossings, curbing disease spread and improving water quality (Subalsusky et al. 2017). Additionally, the Green Turtle (*Chelonia mydas*) grazes heavily on seagrass, particularly *Thalassia testudinum*, positively influencing its productivity and composition through grazing (Moran & Bjorndal 2005).

Freshwater Fishes

Urban and commercial expansion is impacting various freshwater fish species, including *Botia striata* (EN), *Garra bicornuta* (NT), *Monopterus indicus* (VU), *Neotropius khavalchor* (DD), *Puntius sharmai* (EN), *Eutropiichthys goongwaree* (DD), and *Monopterus fossorius* (EN). In cities, tourism and recreational water activities near rivers adversely affect endemic species like *Garra surendranathanii* (EN), *Horabagrus nigricollaris* (EN), *Hypselobarbus periyarensis* (EN), *Osteochilus longidorsalis* (EN), *Parapsilorhynchus elongatus* (EN), *Puntius tambraparniei* (EN), and *Travancoria elongata* (EN). Many of these fish species are consumed regularly as part of local diets (Dahanukar et al. 2011).

City development often requires the construction of dams to provide water and mitigate floods. However, dams block fish migration and severely impact species like Anguilla bicolor (LC), which swims upstream to breed. Kerala's major rivers, including Periyar and Chalakkudy—home to numerous threatened fish species—have been extensively dammed, resulting in the disruption of fish migration and endangerment of native species (Raghavan et al. 2008a). Across Kerala, approximately 53 reservoirs have been created due to dam construction (Harikumar & Rajendran 2007).

Habitat alteration from widespread deforestation and conversion of forests into tea, coffee, rubber, and cardamom plantations has significantly impacted freshwater fish. Kerala experienced an annual forest cover decline of 0.9% between 1961 and 1988 (Prasad et al. 1998). The loss of forest cover at such alarming rates affect many riverine fish in the region since they rely on external food resources.

Plants

India boasts a wealth of natural resources and is home to approximately 15% (3,000–3,500) of the world's 20,000 medicinal plant species. About 2,000 of these plants are known for their medicinal properties and are utilized across traditional systems like Ayurveda, Unani, Siddha, and Homeopathy. Tribal and rural communities in India heavily rely on these plants for their healthcare needs, including treatments for livestock. The Western Ghats, renowned for its rich biodiversity, unique vegetation, and high levels of endemism, serves as a significant reservoir of medicinal plants (Raghupathy & Newsmaster 2009; Sasi et al. 2011).

A study conducted in Anaikatti hills surveyed remote rural villages, interviewing two to three local herbal healers per village to gather firsthand information on plant-based remedies. The study identified 85 plant species from 48 families, many from *Solanaceae*, *Asteraceae*, and *Amaranthaceae*, commonly used for ailments like fevers, stomach aches, respiratory issues, skin diseases, joint pain, hair loss, dysentery, diarrhea, snakebite, jaundice, and malaria. Some plants addressed complex conditions like heart disease, kidney disorders, cancer, and diabetes. Additionally, 20 plant species from 17 families and 18 genera were specifically noted for treating heart and kidney conditions. The Irula community selectively utilize 19 plant species from 15 families, including *Amaranthaceae*, *Asclepiadaceae*, *Cucurbitaceae*, *Lamiaceae*, *Fabaceae*, *Malvaceae*, *Menispermaceae*, and *Nyctaginaceae*. If we decide to construct a city in the name of development, this decision may lead many endemic and medicinal plants towards extinction and will also increase more pressure on the existing edible plants by the city people, exploiting the plant resources (Ganesan et al. 2015).

Mammals

Forest elephants are vital ecosystem engineers, significantly shaping their habitats through their behaviors. Their size plays a crucial role; merely by walking, they alter the environment, and when moving in herds, their impact increases manifold. Although their activities may seem destructive, they create conditions for large trees to establish deep roots and grow to towering heights, thus shaping the forest canopy. Without elephants, competition for light and nutrients would intensify, slowing tree growth and limiting their maximum potential size. Additionally, elephants clear vast areas of the forest floor, creating spaces for new seedlings to germinate. Seeds that pass through their digestive systems benefit from improved germination rates and faster growth.

Elephants consume over 500 plant species and aid in the seed dispersal of at least 43 species in Central Africa. Many fruiting plants depend on animals for widespread seed dispersal, and some, like the navel fruit trees of the Omphalocarpum genus, rely solely on elephants. These trees produce large, hard, trunk-growing fruits (cauliflorous) with thick husks, which only elephants can eat and disperse. The loss of elephants could lead to the decline of such plant species.

Poulsen (2018) highlights that forests without elephants often develop dense understories and middle layers filled with thorny vines and herbaceous vegetation, making visibility and movement difficult. In contrast, elephant-inhabited forests resemble open parks with clear visibility and well-worn trails. He also suggests that beyond deforestation, the loss of elephants could reduce forests' ability to store carbon.

Tropical forests play a critical role in global carbon storage, and forest elephants are essential for the growth and survival of large trees. Their decline would result in reduced carbon sequestration by African forests, contributing to global warming (Clark 2018).

Birds

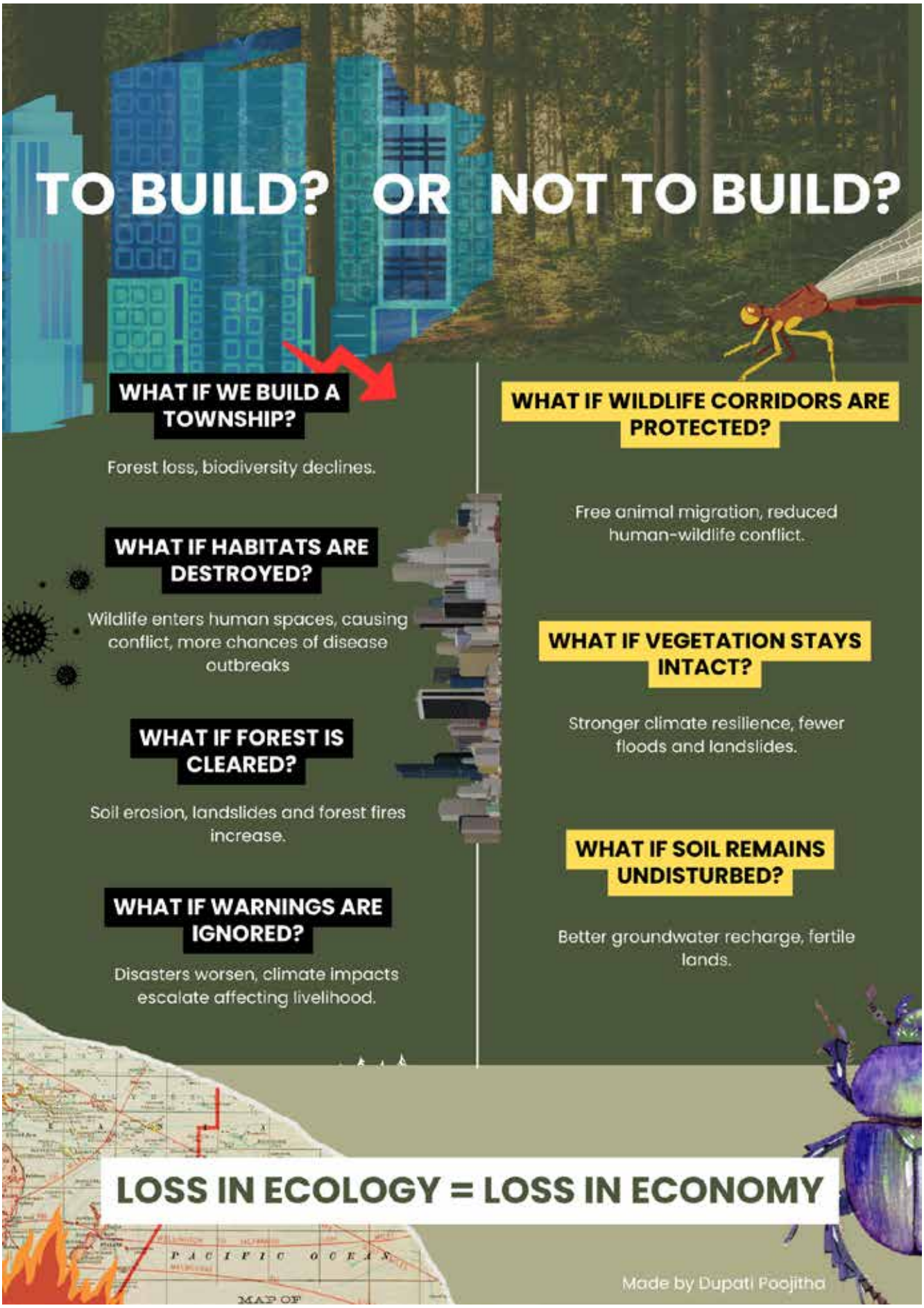
The diversity of bird species is a strong indicator of ecosystem health. Many birds are highly sensitive to pollution, making them effective indicators of potential human health risks from environmental contaminants. Unfortunately, bird populations are declining due to factors such as climate change, habitat loss, and fragmentation (Ceballosa et al. 2017). In India, research has identified over 290 bird species involved in pollination and seed dispersal, with sunbirds and mynas among the most significant pollinators (Balasubramanian et al. 2012). Birds play a crucial role in maintaining biodiversity and supporting ecosystems and agroecosystems through their pollination behaviors (Kellermann et al. 2008). They also act as primary seed dispersers for approximately 80,000 angiosperm species, facilitating reforestation in deforested areas and reducing reforestation costs. This, in turn, helps mitigate climate change and benefits humanity in the long term (Mahendiran et al. 2015; Wunderle et al. 1997).

Birds contribute significantly to pest control, with studies showing they can reduce invertebrate populations by 20–70% in natural and agricultural areas, leading to decreased plant damage and mortality. This reduction can result in up to a 60% increase in crop yield or fruit production (Jedlicka et al. 2014; Whelan et al. 2015). Birds also play a key role in waste management; for instance, vultures in the Serengeti consume hundreds of pounds of carcasses per kilometer annually, while those in Yemen remove up to 25% of urban organic waste (Gangoso et al. 2013). The decline of scavenger populations can increase the spread of diseases in humans, livestock, and wildlife, as vultures efficiently dispose of carcasses and prevent infections. For example, the decline in vulture numbers has been linked to a rise in rabies cases, resulting in approximately 48,000 human deaths (Markandya et al. 2008). These examples highlight the critical role of birds in supporting human health and ecosystems.

Additionally, birds contribute to agriculture, with studies showing that their droppings, rich in nutrients such as potassium, nitrogen, and phosphate, act as natural fertilizers. These nutrients convert to ammonia, enriching soil nitrogen content and promoting plant growth. Birds are estimated to provide a 38% global contribution to agriculture through this natural fertilization process (Clay et al. 2004).

Key Conclusion:

The cumulative effects of human disturbance on forests in eco-sensitive areas like the Western Ghats are alarming. Over time, the continuous pressure from activities such as deforestation, agriculture, urbanization, and infrastructure development has led to significant degradation of the region's natural ecosystems. Carefully managing agricultural and urban expansion are critical to mitigating these cascading impacts. Biodiversity loss poses an existential threat to human survival and existence by undermining ecosystems that provide essential services, support economies, and safeguard health. Addressing this crisis requires transformative changes across sectors. Conservation and restoration of ecosystems are essential to protect biodiversity, while sustainable production and consumption practices can reduce environmental pressures. Integrating biodiversity into policies for food systems,


TO BUILD? OR NOT TO BUILD?
WHAT IF WE BUILD A TOWNSHIP?
Forest loss, biodiversity declines.
WHAT IF HABITATS ARE DESTROYED?
Wildlife enters human spaces, causing conflict, more chances of disease outbreaks
WHAT IF FOREST IS CLEARED?
Soil erosion, landslides and forest fires increase.
WHAT IF WARNINGS ARE IGNORED?
Disasters worsen, climate impacts escalate affecting livelihood.
WHAT IF WILDLIFE CORRIDORS ARE PROTECTED?
Free animal migration, reduced human-wildlife conflict.
WHAT IF VEGETATION STAYS INTACT?
Stronger climate resilience, fewer floods and landslides.
WHAT IF SOIL REMAINS UNDISTURBED?
Better groundwater recharge, fertile lands.
LOSS IN ECOLOGY = LOSS IN ECONOMY
PACIFIC OCEAN
MAP OF
Made by Dupati Poojitha

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A walk-through the Wildlife (Protection) Act, 1972: Journey till now and the way ahead

Introduction

India, with its rich array of ecosystems spanning terrestrial, freshwater, and marine environments, is recognized as one of the world's most significant biodiversity hubs. The presence of four global biodiversity hotspots—the Himalaya, the Western Ghats & Sri Lanka, Indo-Burma, and Sundaland—further emphasizes the nation's ecological significance. Yet, this immense diversity faces growing threats from anthropogenic activities, climate change, and unsustainable development, making it urgent to plan conservation efforts.

Globally, biodiversity is being lost at an alarming rate due to various reasons such as human activities (Bourgoin et al. 2024), land use change (Cabernard et al. 2024) and global warming (Price et al. 2024), despite numerous initiatives to halt this decline. India, however, continues to stand out, boasting the largest populations of charismatic species like the Royal Bengal Tiger (Goodrich et al. 2022) and the Asian Elephant (Williams et al. 2020). These achievements reflect not only modern conservation efforts but also the nation's deep-rooted historical and cultural connection with nature. From the sacred groves of ancient communities to religious reverence for species such as snakes and peacocks and trees like the banyan and neem, India has long practiced forms of conservation rooted in coexistence and reverence for the natural world.

The conservation ethos in India dates back to the 3rd century BCE, when Emperor Ashoka enacted edicts banning hunting and protecting wildlife. However, the colonial period marked a turning point, as large-scale exploitation of forests and wildlife led to the depletion of many species. Post-independence development pressures further exacerbated this crisis, driving some species to the brink of extinction. The Wildlife (Protection) Act, 1972 (WPA, 1972), was a landmark legislation aimed at reversing this trend. Enacted in the wake of the Stockholm Conference, the Act provided a legal framework for protecting species based on their conservation needs, establishing protected areas, and regulating activities that threaten biodiversity. Over the past half-century, the Act has played a crucial role in the recovery of flagship species like the Royal Bengal Tiger, Asiatic Lion, and Asian Elephant.

However, despite its successes, the Act has several limitations. It struggles to address modern conservation challenges such as habitat destruction, human-wildlife conflicts, and unresolved forest rights. Its lack of adaptive and inclusive mechanisms has made it difficult to respond effectively to the evolving complexities of conservation in India.

This raises a pressing question: Why is wildlife still under threat despite a strong legal framework like the WPA, 1972? Is it a failure of implementation, an inability to adapt to emerging challenges, or inherent gaps in the Act itself?

This article seeks to critically analyse the evolution of conservation efforts in India, from the pre-colonial era to the present. By examining the history of the WPA, 1972, its amendments, successes, failures, and discrepancies, we aim to shed light on the gaps that hinder its effectiveness. Additionally, we will explore the importance of adaptive and inclusive conservation strategies that integrate ecological, social, and legal complexities to address the modern challenges of biodiversity conservation in India.

Conservation through the ages

In this section, we will explore the evolution of nature conservation in India across different

historical periods. Starting with the pre-colonial era, we will examine traditional practices and early governance systems that emphasized environmental stewardship. Moving to the colonial period, we will analyse the impact of British policies on forests and wildlife. The post-colonial era highlights India's efforts to rebuild its conservation framework after independence. Finally, we will look at the current era, focusing on developments after 1972, marked by significant milestones like the Wildlife Protection Act and the growing emphasis on sustainable conservation practices.

Conservation through the ages: Pre-colonial era

In the pre-colonial era, nature conservation in India was rooted in key historical periods. The Arthashastra by Chanakya emphasized resource management, while Ashoka's Mauryan reign introduced policies for protecting animals and forests. The Gupta dynasty culturally revered nature, and the Mughal era contributed through afforestation and biodiversity documentation. These phases highlight how ancient and medieval India understood and practiced conservation, shaping the foundations of environmental stewardship in the region.

As quoted by Sanjay Molur, India has long been considered a land of nature worshippers, with pre-colonial views of nature deeply influenced by religious and cultural beliefs (Roy & Fleischman 2022). The Vedas reflect a profound reverence for nature, and texts like the Mahabharata and Ramayana emphasize wildlife protection, with Rishis warning against deforestation. Cultural traditions linked birth stars to trees, fruits, and animals, and the practice of totemism associated tribes with specific plants or animals, reinforcing the associations between humans and wildlife. While methods of wildlife protection evolved, the core understanding of conservation remained consistent from this period onward.

Kautilya emphasized afforestation, particularly promoting monoculture plantations, with the goal of enhancing the nation's forest reserves by cultivating valuable tree species (Roy & Fleischman 2022). Elephants, essential for warfare, were safeguarded by the rulers, and their tusks were considered state property. To protect these animals, the Mauryan rulers established dedicated forests (Saravanan 2024).

Ashoka advocated for planting trees along roads and ending the practice of forest burning. In accordance with the 14 rock edicts, he promoted the cultivation of fruit trees and medicinal herbs on wastelands. His reign introduced Abhayaranya, the first concept of sanctuaries and national parks in India, aimed at restoring forests and their resources. Additionally, the adoption of metal tools, such as those made from copper and iron, reduced dependence on forest products, reducing forest exploitation (Roy & Fleischman 2022).

The Gupta dynasty (200–600 BCE) upheld earlier forest governance practices but introduced regulations that significantly transformed forests into agricultural land. Celebrated as the "Golden Age of India," the period encouraged peasantry by converting forests and uncultivated areas into farmland (Roy & Fleischman 2022).

Hunting in India dates back to before the Mughal era, serving as both a prestigious pastime and a critical skill for warfare. Islamic teachings, based on Quranic interpretations, highlighted the forests as divine gifts, without imposing restrictions on their exploitation. Forest-dependent communities were granted certain privileges and responsibilities related to forest resources, although the Mughals showed little interest in forest restoration or protection. During the Mughal era (AD 1526–1761), hunting remained a prominent activity, not only in India but globally. Abul Fazl described hunting as a source of knowledge (Roy & Fleischman 2022).

In pre-colonial times, forests were appreciated for their aesthetic, wildlife, and economic value.

Conservation efforts, deeply influenced by cultural and religious beliefs, focused on afforestation with "valuable species" and garden creation. Decisions on conservation were predominantly made by rulers, traditional experts, or wise individuals (Roy & Fleischman 2022).

Conservation through the ages: Colonial era

In the 19th century, wildlife populations in India declined dramatically due to the construction of railroads and the expansion of British control. Although conservation efforts began during this period, they were primarily motivated by British administrative and commercial interests, rather than genuine ecological concerns. The colonial forestry system sought to exploit forest resources, dismantle regional forest management systems, and alter forest boundaries to serve agronomic and economic purposes. British control over forestry was formally established in 1847 with the creation of the Bombay Forest Conservancy and in 1864 with the establishment of the Imperial Forest Department.

Moreover, British colonial rule in India established significant control over natural resources, particularly timber, through the Forest Act of 1878, which brought over 20% of the region's forests under government jurisdiction. Hunting within these state-controlled forests required licenses that were selectively issued to Europeans and rarely granted to Indians (Sharma & Tripathi 2024). This policy increased social inequalities and empowered Forest Department officials to regulate poaching. For the British, hunting symbolized their dominance over both nature and the colonized population, with tiger hunts serving as a powerful representation of their authority. Predators such as tigers and leopards were labelled as "vermin" and targeted for extermination, while elephants received special protection due to their cultural and symbolic importance. This dichotomy reflected colonial ideologies, with predators like tigers and lions often compared to rebellious individuals, reinforcing the narrative of domination and control. The widespread killing of these animals was portrayed as a cultural triumph and a display of colonial power. Also, the East India Company awarded 5–10 rupees for tiger hides and increased rewards to 20–50 rupees for adults and 10–20 rupees for cubs by the 1860s. Between 1875 and 1925, over 80,000 tigers, 150,000 leopards, and 200,000 wolves were killed (Rangarajan 2012). As British authority grew stronger, hunting became increasingly regulated with strict codes, reflecting the imperial grandeur of the time and further deepening the divide between Britons and Indians.

By the 1850s, sport hunting in India had evolved into a grand spectacle, merging Mughal opulence and princely traditions with British customs. These big-game hunts symbolized status, masculinity, power, and wealth. Prominent figures like Viceroys, Governors, and Commissioners actively supported and often took part in these extravagant hunting expeditions, capitalizing on the unique opportunities India provided for such activities.

By 1920, lions were extinct in British India, surviving only in the Princely States of Saurashtra. The situation was equally dire for cheetahs, which were overhunted to the brink of extinction due

to their perceived threat to game species and livestock. Apart from the predators, herbivores like the Nilgiri Tahr, once estimated at 25,000–30,000 in the Palani Hills during British rule, faced severe losses. Historical accounts mention British soldiers consuming tamed Tahr herds during Arthur Wellesley's campaign against Tipu Sultan (Sekar 2004; Sekar & Srivastav 2024). Today, the Nilgiri Tahr is Endangered, with only about 3,100 individuals surviving across 5,790 km² of forests in Tamil Nadu and Kerala (World Wildlife Fund 2015). The 18th and 19th centuries saw extensive wildlife destruction for food, recreation, and commercial purposes, alongside deforestation for infrastructure projects like railways, highways, and dams.

Eugene Malville Van Ingen established a successful taxidermy business in Mysore in 1912, handling around 43,000 tiger skins during its operation (Allum 2015). Taxidermy, which had been thriving in Mysore since 1900, involved preserving hunted animals as treated, stuffed, and mounted displays that decorated palaces, royal residences, military lounges, government offices, and museums (Sekar & Srivastav 2024). The popularity of tiger hunting spurred widespread tiger-shooting advertisements. For instance, a British Indian newspaper in 1904 promoted "Cordite Rifles" as ideal for killing tigers. E.P. Gee, a former hunter turned conservationist, estimated that India had 40,000 tigers at the beginning of the 20th century, but by 1964, the population had plummeted to just 4,000 (Gee 1964; Green 2006). Excessive hunting of deer and boar in the colonial period diminished the food supply for large predators, resulting in the decline of rhinos and wild buffalo population in north Bengal by the 1850s and a decrease in Nilgai numbers. The reduction of essential prey animals resulting in heightened predation on Indian One-horned Rhinoceros and Wild Buffalo. Furthermore, rhinos and buffaloes also were pursued for their horns and flesh, which hastened their decrease. Colonial policies, such as restricting Santhal tribal hunts, disrupted natural checks on wild animal populations.

Hunting during colonial India involved meticulous preparations, with royal tours often resembling grand festivals. British sportsmen popularized tiger shooting from elephant backs or machans using live bait, supported by large entourages of trackers, beaters, and weapons. In 1926, R.C. Morris's pursuit of rogue elephants in Coimbatore involved a three-shooter team and numerous aides, highlighting the scale of such hunts (Daniel 1998).

Sadul Singh of Bikaner recorded killing nearly 50,000 animals and 46,000 birds over 25 years (Rangarajan 2001). Historian John Mackenzie noted motives for hunting included recreation, trophies, food, and protection of crops and livestock (Mackenzie 1997). By the mid-19th century, forest clearance for plantations intensified wildlife conflicts, with herbivores damaging crops and carnivores attacking livestock. Local hunters (Shikaris) emerged, and hill stations became popular hunting grounds, worsening habitat loss. Amidst all these destructions, legal conservation measures only began in the 1870s (Sekar & Srivastav 2024).

In the 1870s, the British government evaluated local practices across its territories to identify effective

ways to eliminate wildlife considered problematic. This policy shift marked the beginning of state-driven wildlife management, prioritizing control over conservation (Weil 2006).

Initially focused on destruction, British India later introduced Forest Acts to conserve wildlife while retaining control over animals and forest resources (Weil 2006). Colonial officials and naturalists primarily sought to protect wildlife for hunting purposes. By the early 20th century, attitudes towards wildlife shifted, moving from eradicating "undesirable" species to valuing nature and animal life. This change, driven by officer-hunters turned naturalists, sparked a wildlife preservation movement. Conservation efforts emerged through policies, legislation, and advancements in scientific forestry. Early laws like the Indian Forest Act of 1878 and the Arms Act of 1878 aimed to manage wildlife by regulating hunting and reserving forests but often restricted local communities' access in favour of colonial interests. Europeans retained hunting privileges, while locals' rights were curtailed. Species-specific protections began with acts like the Cattle Trespass Act (1871) and the Madras Elephant Preservation Act (1873), later extended nationwide in 1879. The Central Government's Elephant Preservation Act of 1879 prohibited killing or capturing wild elephants, except under specific circumstances, with penalties for violations including fines or imprisonment.

The Nilgiri Fish and Game Preservation Act of 1879 aimed to curb wildlife overexploitation in the Nilgiris, Coimbatore, and Malabar regions (Davidar, 2012). It sought to conserve game species, introduce new ones, and regulate hunting as part of British recreational activities. The Act introduced closed hunting seasons, protected young animals, and restricted hunting near roads, waterholes, or from platforms like machans. Night hunting was prohibited, and small game hunting was limited to two days a week. Penalties were imposed for violations, including failing to track wounded dangerous animals. The Act also banned egg collection from species such as peafowl, junglefowl, and spurfowl, and employed game wardens and fish watchers to deter poaching (Davidar 2012).

The Madras Forest Act of 1882 emphasized forest classification, tree preservation, fire prevention, and restrictions on cultivation and grazing. It prohibited the removal of forest resources, including animal parts like tusks and skins, from reserved forests. Hunting and fishing were regulated through measures such as banning water poisoning and trap setting. Closed-season hunting restrictions were introduced to safeguard wildlife, along with annual limits on animals like two sambars, one bison, two barking deer, and two antelopes (Sekar 2015). The Act also implemented hunting quotas, licensing requirements, and exclusive shooting zones for elites.

India's first national wildlife protection law, the Wild Birds Protection Act of 1887, limited the possession or sale of certain wild birds during their breeding season but did not ban their hunting. The Act was enforced only in municipal and cantonment areas, leaving other regions unregulated. It introduced the ideas of 'closed areas' and 'closed seasons' for hunting (Sekar 2004; Sekar & Srivastav 2024). However, it proved ineffective in curbing the widespread killing of wildlife throughout British India.

Both the Wild Birds Protection Act of 1887 and earlier legislation focused primarily on regulating hunting, neglecting the critical issue of wildlife trade, which continued to deplete animal populations. To address this gap, the Wild Birds and Animals Protection Act of 1912 was enacted. This Act introduced closed hunting seasons and a licensing system to regulate the hunting of certain species, particularly during breeding periods. It also authorized state governments to establish closed periods to restrict hunting and trade during vulnerable times. Expanding upon the 1887 Act, the

1912 law criminalized the killing or capturing of wild animals and birds. However, species like elephants, tigers, and lions were exempted, as the British administration classified them as vermin and allowed their hunting for trophies. Despite its broader scope, the law failed to tackle the impact of wildlife trade and was largely ineffective in curbing the hunting of these iconic animals.

The Wild Birds and Animals Protection Act of 1912 was amended in 1935 (Act XXVII of 1935) to grant provincial governments the authority to designate sanctuaries for the protection of birds and animals. Within these sanctuary areas, hunting or capturing wildlife was strictly prohibited at all times. The amendment also expanded the schedule to include additional species under protection. However, hunting of species not listed in the schedule remained permissible outside the sanctuaries. This amendment strengthened legal protections for wildlife within sanctuary boundaries and paved the way for the United Provinces National Parks Act of 1935, which facilitated the creation of Hailey National Park (now Corbett National Park), the first national park in British India.

The Indian Forest Act of 1927 aimed to promote environmental conservation by designating certain areas as "reserves," thereby safeguarding forests and wildlife. Similarly, the Bengal Rhinoceros Preservation Act of 1932 sought to protect wild rhinoceroses in the Bengal Presidency by prohibiting their killing, injury, or capture, except in self-defence or with government authorization. This era saw the emergence of notable conservation efforts, building on earlier legislation such as the Wild Birds Protection Act (1887) and the Elephant Preservation Act (1889), which preceded the 1912 Act that introduced stricter measures, including a ban on night tiger hunts (Mandala 2015).

The early 20th century also marked the creation of wildlife reserves like Kaziranga, Corbett National Park, and Banjara Valley, influenced by conservationists like Jim Corbett. However, the focus remained on regulating hunting rather than addressing the wildlife trade, a significant driver of biodiversity loss (Mandala 2015). During World War II, the Southeast Asian Command's training camp in Mudumalai caused extensive destruction of wildlife (Sekar, 2004; Sekar & Srivastav 2024).

Cultural and religious beliefs also influenced conservation practices. For instance, Salem shepherds avoided killing wolves, attributing spiritual significance to their presence, while the Bishnoi community strictly safeguarded blackbucks and Khejri trees through rigorous local traditions (Rangarajan 2001). Similarly, the Nawab of Junagarh took significant steps to protect Asiatic Lions by limiting habitat destruction and hunting in the Gir region. Despite these efforts, the conservation laws and initiatives of the era achieved only limited success in tackling the widespread issues of species decline and habitat loss.

Prior to India's independence, environmental protection relied on general legal principles like nuisance or negligence under the Indian Penal Code (1860) and the Criminal Procedure Code (1898). While the Indian Penal Code does not directly address wildlife, it defines "animal" under Section 47 and criminalizes acts like maiming or killing animals under Sections 428 and 429, imposing legal penalties for such offenses. Similarly, the Motor Vehicles Act of 1939 was inadequate in curbing the exploitation of natural resources or addressing the environmental damage caused by industrial activities.

Conservation through the ages: Current era

After gaining independence, India made notable progress in wildlife conservation through legislative, executive, and judicial initiatives. In the 1950s, the Rhinoceros Preservation Act and Elephant Preservation Act were enacted to safeguard key species. A significant development occurred in 1952 with the establishment of the Central Board for Wildlife, which fostered discussions on

creating sanctuaries and national parks, marking a coordinated conservation effort. Sri Jayachamaraja Wadiyar, Maharajah of Mysore, chaired the Board and actively shaped its goals and responsibilities (Ramesh 2020).

During its inaugural meeting, the Board renamed itself the Indian Board for Wildlife (IBWL) and, in subsequent sessions, passed resolutions to protect species such as the Snow Leopard, Rhinoceros, and Great Indian Bustard. The IBWL also played a key role in encouraging the Indian government to prioritize the conservation and expansion of the Asiatic Lion population in Gir (Ramesh 2020). However, post 1965, the IBWL stopped convening, leading to a temporary decline in biodiversity conservation discussions within the government.

Institution of the Wildlife Protection Act, 1972

Although wildlife trade generated significant foreign exchange for India and served as an important livelihood source for many, its harmful and rapid impact on the country's wildlife could not be overlooked. In 1968, India officially banned the export of animal fur. In 1969, during the International Union for Conservation of Nature's triennial meeting in New Delhi, then Prime Minister Indira Gandhi remarked, "*We need more foreign exchange but not at the cost of the life and liberty of some of the most beautiful species in the country*", thereby establishing the nation's wildlife protection objectives (Badola 2023). Following this, the Prime Minister restructured the Indian Board for Wildlife (IBWL) and appointed Dr. Karan Singh as its chairman (Ramesh 2020).

In 1972, India took part in the United Nations Conference on the Human Environment in Stockholm, Sweden, the first global conference to place environmental issues at the forefront of international discussions (United Nations 1973). Building on this momentum, Prime Minister Indira Gandhi championed the enactment of the Wildlife Protection Act, 1972, positioning it as a central legal framework for wildlife conservation in India. The Act was passed by Parliament during its winter session in 1972, providing significant support to Project Tiger and the nationwide ban on tiger hunting implemented in 1973 (Badola 2023).

Evolution and Rectification of the Wildlife Protection Act: 1972–2022

The enactment of the Wildlife Protection Act in 1972 marked a significant milestone in India's efforts to conserve its rich biodiversity. However, like any newly introduced legislation, the Act faced several challenges in its implementation, such as addressing emerging conservation needs, evolving ecological threats, and balancing human-wildlife coexistence. To tackle these challenges and ensure the law remained relevant and effective, it became necessary to amend the Act periodically. Over the years, major amendments were introduced in 1982, 1986, 1991, 2006, 2013, and 2022, each addressing specific gaps and strengthening the legal framework to adapt to changing conservation priorities and ground realities. Let us go through the major changes brought in by these amendments and the gaps they tried to fill with.

The Wildlife (Protection) Amendment act 1982, 1986 and 1991

The first amendment to the Act was introduced in 1982, introducing provisions for the scientific translocation and population management of animals, along with changes related to trade licensing.

The next significant amendment to the WPA came in 1986, introducing key provisions for regulating and monitoring wildlife trade under Chapter VA, titled "Prohibition of trade or commerce in trophies, animal articles, etc. derived from certain animals." Furthermore, the manufacture and trade of ivory articles were no longer exempt under the Act.
A significant amendment to the WPA was introduced in 1991, bringing several key changes. These included the addition of Chapter IIIA, titled

"Protection of Specified Plants," and Chapter IVA, titled "Central Zoo Authority and Recognition of Zoos." This amendment also saw the removal of Section 10 and the abolition of "Game Reserves."

A common thread across the WPA amendments of 1982, 1986, and 1991 is the growing centralization of authority. Moreover, there are notable gaps where the protection of wildlife and specific geographic areas is entirely dependent on the discretion of government authorities, as evident in certain sections of the Act.

The Wildlife (Protection) Amendment act 2002

The 2002 amendment to the Wild Life Protection Act introduced several significant changes aimed at strengthening wildlife conservation and management. It emphasized ecological and environmental objectives in the Act's long title and added new definitions to support the proposed amendments. The amendment gave statutory status to the National Board for Wildlife, restructured State Wildlife Advisory Boards to ensure broader representation, and introduced safeguards to prevent the killing of animals under the guise of them being dangerous to human life and property. It streamlined and expedited the final notification process for sanctuaries and national parks to mitigate biodiversity loss during the interim period and required National Board for Wildlife recommendations for any boundary changes to these protected areas. The amendment banned the commercial sale of forest produce from national parks and sanctuaries, prohibited construction of commercial tourist infrastructure within these areas without prior approval from the National Board for Wildlife, and empowered officers to evict encroachments from these protected zones. It also established provisions for the creation and management of conservation reserves and community reserves, mandated that zoos acquire or dispose of animals only through recognized facilities, and restricted the acquisition of Schedule I and II animals or their derivatives to inheritance only. Additionally, the amendment enhanced penalties for offenses, incorporated provisions modelled after the Narcotic Drugs and Psychotropic Substances Act, 1985, for serious wildlife crimes, increased rewards for assisting in detecting offenses, raised the compensation ceiling from ₹2,000 to ₹25,000, and mandated the confiscation of vehicles, weapons, and tools used in compoundable offenses, ensuring they were not returned to offenders.

The Wildlife (Protection) Amendment Act, 2006

In 2006, there were some major changes brought in to the act. Under Section 348 of the Wildlife (Protection) Amendment Act, 2006, the Central Government established the Wildlife Crime Control Bureau, also referred to as the Tiger and Other Endangered Species Crime Control Bureau, comprising various directors, commissioners, and other officers. Another significant change was the establishment of the National Tiger Conservation Authority (NTCA). Initially formed as the Tiger Task Force (TTF) in 2005, it was later given legal recognition under the Wildlife (Protection) Act in 2006. This amendment holds particular importance in the context of the alarming decline in tiger populations, reflecting the government's commitment to protecting tigers through innovative approaches and institutional frameworks. The NTCA is also tasked with providing a clear vision to the Parliament while prioritizing the livelihood security of communities residing in and around tiger reserves.

The Wildlife (Protection) Amendment Bill, 2013

Although this bill did not progress to become an act, it served as a significant stepping stone in the development of the Wildlife Protection Act, introducing many globally relevant concepts and sparking important conversations around them. The 2013 amendment bill was introduced in response to the rising incidence of wildlife crimes, the need to encourage community participation, the ever-evolving biological landscape, and India's international obligations under the Convention on

International Trade in Endangered Species of Wild Fauna and Flora (CITES), of which India is a signatory. Key provisions included banning the use of animal traps without prior approval, allowing permits for scientific research under strict conditions, increasing penalties for wildlife-related offenses, and safeguarding the rights of local communities, particularly Scheduled Tribes in the Andaman and Nicobar Islands. The bill required anyone possessing animal traps to declare them within 60 days of enactment and prohibited their use, trade, or ownership without the approval of the Chief Wildlife Warden.

Additionally, the bill allowed for certain exemptions, such as livestock grazing, movement, and the legitimate use of water for drinking and household purposes by local communities. It sought to regulate the trade of Endangered species and introduced specific schedules for flora and fauna in line with CITES requirements. However, despite its progressive measures, the bill faced criticism for its impracticalities and accountability gaps. For instance, one major change involved redefining ‘wild animal’ to include any animal found in the wild, extending protections to all fish except those bred in captivity. Critics argued this could severely impact the fishing industry and local livelihoods, as licenses would be required for selling, cooking, or purchasing fish. Researchers also expressed concern that such a broad definition could reduce the clarity and enforceability of the Act, complicating wildlife regulation.

Further, the bill required Gram Sabha consultations before designating any Scheduled Area as a National Park, but it lacked a robust mechanism to monitor these consultations, raising concerns about transparency and effective implementation. The imposition of stricter penalties, such as a minimum seven-year imprisonment and fines ranging from ₹5 lakh to ₹30 lakh for offenses in tiger reserves, was criticized for being overly harsh, potentially deterring courts from convicting offenders. While the Chief Wildlife Warden was authorized to issue research permits, concerns were raised about the potential for excessive bureaucratic control over conservation research. Minor infractions, such as trespassing or violating permit terms, could result in a minimum three-year imprisonment and fines, potentially stifling ecological research and academic freedom. Despite its ambitious objectives, the bill encountered procedural delays and was eventually withdrawn on 18 March 2015, without becoming an amendment to the law. This highlighted the challenges of wildlife governance in India, emphazising the need for a balanced approach that integrates ecological conservation with the socio-economic realities of a diverse nation. Lessons from this experience informed the subsequent Wildlife (Protection) amendment Act of 2022.

The Wildlife (Protection) Amendment Act, 2022: A Road Ahead

The 2022 amendment to the Wildlife Protection Act focused on strengthening wildlife conservation through three primary avenues: implementing India's commitments under CITES, protecting native species, and enhancing law enforcement measures. A significant change introduced in the very first page of the Act was the replacement of the phrase "protection of wild animals, birds, and plants" with "conservation, protection, and management of wildlife." This substitution has been widely regarded as a progressive and holistic shift, reflecting a broader legislative intent to address wildlife conservation in a more dynamic and comprehensive manner.

The inclusion of "invasive alien species" in the amendment was another crucial step, addressing the severe ecological challenges posed by invasive species, an issue compounded by limited research and management efforts across India's diverse ecosystems. A major overhaul of the Act was the revision of its schedules, reducing their total number from six to four. The revised structure now includes two schedules for specially protected animals—

Schedule I (providing the highest level of protection, covering 597 species) and Schedule II (offering lesser protection, covering 1,553 species); one schedule for specially protected plants (Schedule III, which now lists 19 species, up from the previous six); and Schedule IV, which focuses on regulating trade in species listed under CITES. Schedule IV is further divided into three appendices: Appendix I (627 species), Appendix II (497 species), and Appendix III (217 species), all of which represent species subject to international trade restrictions to prevent over-exploitation and align with global biodiversity conservation efforts.

The amendment also introduced an entirely new chapter (Chapter VB) to reflect India's obligations under CITES. This chapter regulates international wildlife trade and ensures India's legislation aligns with its global commitments. Additionally, the amendment expanded the scope of permitted activities in protected areas, allowing for filmmaking alongside photography, scientific research, and tourism, provided such activities do not harm wildlife or their habitats.

Several other provisions in the amendment aim to further strengthen wildlife conservation and management. For instance, the definition of "Person" has been expanded to include firms, companies, authorities, and associations, thereby broadening accountability under the Act. The term "zoo" has also been redefined to include ex-situ conservation facilities and rescue centres. The requirement to consult Gram Sabhas while preparing management plans for wildlife sanctuaries underscores the importance of involving local communities in conservation efforts. Restrictions on renewing arms licenses for individuals residing within 10 km of wildlife sanctuaries aim to better regulate human activities near sensitive areas. Additionally, the Act mandates the surrender of captive animals, trophies, and other wildlife products without imposing punitive measures or offering compensation, simplifying compliance.

Finally, the amendment enhances enforcement mechanisms by empowering the Management Authority and officers of the Wildlife Crime Control Bureau (WCCB) to file legal complaints, thereby improving the capacity to address wildlife-related offenses and violations.

Despite the numerous amendments made to the Wildlife Protection Act over the years, challenges in its enactment and implementation persist. These amendments have indeed strengthened the legal framework, but gaps remain in effectively enforcing these laws, particularly in addressing wildlife crimes, habitat degradation, and human-wildlife conflict. Issues such as inadequate funding, bureaucratic hurdles, lack of coordination between authorities, and challenges in local community involvement continue to hinder the law's success in achieving its intended conservation goals. These ongoing difficulties highlight the need for a critical examination of the law's weaknesses and the persistent challenges it faces in ensuring effective wildlife protection. In the following section we will delve into some of these issues, exploring the limitations and gaps that still exist within the current framework.

Weaknesses and Challenges in the implementation

The Wildlife Protection Act, despite its important role in safeguarding India's biodiversity, faces several significant challenges in its enforcement and application.

Centralisation of the authority: One of the core issues is the centralization of authority within the legal framework, which has increased over time, particularly through amendments. While centralization aims to create uniformity in policy, it often leads to inconsistent implementation across different states. Local authorities frequently lack the resources, training, and autonomy necessary for effective enforcement. This issue is further compounded by the inadequate enforcement of the

law, particularly in border regions, which are often exploited by wildlife trafficking networks. Despite the imposition of stronger penalties over the years, poaching and illegal wildlife trade persist, with a dismal 2% conviction rate for wildlife crimes. Forest departments and law enforcement agencies are also plagued by limited resources, further hindering their ability to act effectively against wildlife crime.

Prioritisation of development over conservation: The economic pressures of industrialization, agriculture, and urban expansion continue to encroach upon protected areas, further undermining habitat conservation efforts. Establishing new protected areas is complicated by issues such as land acquisition disputes, community resistance, and insufficient funding. These pressures are often prioritized over conservation, leading to weakened protections for biodiversity. In landmark cases like Consumer Education & Research Society vs. Union of India, 1975, the government has allowed the reduction of protected area boundaries to accommodate industrial and economic interests, such as mining, leading to a disconnect between legal provisions and actual wildlife protection.

Weak enforcement: The weak enforcement mechanisms are also reflected in the challenges faced by forest guards and enforcement personnel. They are often inadequately trained, under-equipped, and lack the expertise necessary to handle poaching, wildlife trafficking, or to understand species diversity and animal behaviour. Similarly, police and customs officials, who frequently encounter wildlife crimes, also lack the necessary training to identify illegal wildlife products and deal with cases effectively. Section 11(2) of the WPA, which allows for the killing of animals in self-defence, is also prone to misuse, adding another layer of complexity and ambiguity to enforcement.

Illicit trade: Furthermore, while the WPA has provisions for regulating wildlife trade, illicit trade continues due to insufficient monitoring and poor implementation. The Act's penalties, although strengthened, remain disproportionately low, failing to deter wildlife crimes effectively. Additionally, the Act does not sufficiently address integrated landscape management or long-term solutions for species recovery, which are vital for sustainable conservation.

Overcrowding in the Schedule I: The overcrowding of Schedule I with an excessive number of species, without proper consultation or rationalization, further dilutes the effectiveness of the Act. Some species that may no longer require the highest level of protection are still placed in Schedule I, leading to inefficient resource allocation and complicating conservation efforts. The WPA's limited approach to biodiversity health and ecosystem conservation illustrates a growing need for a more inclusive, scientifically grounded, and transparent approach to conservation in India. Without addressing these gaps, the effectiveness of the Wildlife Protection (Amendment) Act, 2022 will remain limited, leaving significant conservation challenges unmet. We will try to understand some of the most important and crucial challenges and contradictions in the law which may make it difficult for the law to be enforced to conserve the nature as a whole.

Limitations of the NTCA: The National Tiger Conservation Authority (NTCA), established in 2006 under the Ministry of Environment and Forests (MoEFCC) as per Chapter IV B (Section 38L) of the Wildlife Protection Act, plays a pivotal role in tiger conservation in India and itself pose as a challenge to the implementation of the law. Its primary duties include overseeing Project Tiger, approving tiger reserve conservation plans, conducting national tiger population surveys, and maintaining a national tiger database. Additionally, the NTCA supports states in implementing monitoring and protection strategies, addressing human-wildlife conflicts, and promoting community participation in conservation efforts. However, challenges remain in effectively enforcing the law, as NTCA faces issues such as resistance to

modernizing traditional field practices, scrutiny from NGOs and field staff, and pressure to deliver results quickly. Furthermore, its relatively new status poses hurdles in recruitment, training, and infrastructure development, which are essential for enhancing its operational effectiveness.

Contradictory to other laws: A significant challenge lies in the contradiction between the Wildlife Protection Act, 1972, and the Forest Rights Act, 2006. According to the Wildlife Protection Act, before declaring an area as a National Park, the State Government must resolve all forest rights issues and provide alternative resources to forest-dependent communities. Once the National Park is declared, all forest rights are considered resolved. However, there have been instances of protests by people whose rights have not been addressed or resolved. The Forest Rights Act, 2006, was introduced to address these concerns, but it cannot be fully implemented as it contradicts certain sections of the Wildlife Protection Act, 1972. This highlights the need for better integration of laws concerning nature and biodiversity.

Limitations of the CZA: The 1991 Amendment established the Central Zoo Authority (CZA), aimed at regulating zoos and ensuring their role in ex-situ conservation, setting standards for animal welfare, and preventing unethical treatment. However, despite these regulatory measures, issues related to ethical concerns surrounding zoo operations still persist. As already discussed, the 2023 Amendment continued to enforce these regulations but also expanded zoo responsibilities to align with international agreements like CITES and address invasive species concerns. While these amendments reinforced provisions for animal welfare, they have been criticized for ethical gaps, particularly in relation to the rules governing the elephant trade, which could potentially enable exploitation for non-conservation purposes. Although zoos now play a more active role in conservation efforts, such as in rehabilitation and breeding programs, challenges remain in ensuring that all zoos are genuinely committed to animal welfare and conservation. Public trust is often hindered by gaps in regulation and the lack of proper enforcement in certain areas, particularly regarding the treatment of animals and the allocation of resources. Zoos, evolving from simple enclosures to spaces for education and conservation, must navigate the difficult balance between educating the public, ensuring ethical treatment of animals, and contributing meaningfully to wildlife protection efforts.

Decision-making vested on individuals: One other significant challenge in the proper implementation of the law is the concentration of decision-making power in the hands of individuals, particularly the Chief Wildlife Warden. This individual has the authority to decide on key matters such as granting research permits and determining compensation amounts. As the law does not clearly define the criteria for granting permissions or setting compensation amounts, these decisions are left to the discretion of the Chief Wildlife Warden. This creates a situation where personal biases can influence the implementation of the law, which undermines its effectiveness and fairness.

These gaps in policy enforcement and ethical concerns continue to pose challenges for the role of zoos in modern conservation, highlighting the need for more integrated and updated frameworks to address the complex issues of animal welfare, trade, and conservation priorities. Another significant issue is the unscientific and static approach to the listing of species in the protection schedules, which makes the law overly protective and distorts its alignment with broader conservation principle. Here, we are trying to decode and understand the mechanism of listing the specie into the different schedules.

Placing Species in Different Schedules of the WPA, 1972

Another critical challenge is the insufficient scientific approach embedded in the WPA. The Act categorizes

species into different schedules, which determine the level of protection they receive. Although the Act has undergone several amendments over time, its focus largely remains on legal protection rather than a comprehensive approach to conservation of ecosystems and wildlife health. While provisions exist to regulate trade and poaching, they fail to address the broader conservation needs such as habitat restoration and species recovery. Moreover, amendments such as the Wildlife Protection (Amendment) Act, 2022, introduce challenges, especially with the categorization of species into schedules. The absence of a transparent and scientifically rigorous methodology for assigning species to these schedules undermines the credibility of the process. Unlike the IUCN Red List, which uses population trends, habitat conditions, and threat levels to classify species, the WPA's categorization appears arbitrary, leading to misaligned conservation priorities. For example, endangered species like the tiger and Critically Endangered species like the Great India Bustard are placed alongside Least Concern species, such as Jackals and Barn Owls, making it difficult to prioritise species with the greatest conservation needs. Additionally, the inclusion of invasive species in high-protection schedules—such as the Spotted Deer (Chital) in the Andaman Islands—hinders necessary management measures and fails to account for ecological roles and potential impacts on native biodiversity.

Increased risk to species like Tigers and Elephants arises from the Wildlife Protection (Amendment) Act, 2022, as its failure to prioritize conservation resources based on specific threats and needs undermines their effective protection. While these species are granted the highest protection under Schedule I, the lack of a focused approach dilutes the attention and resources required for their conservation. The lack of taxonomic clarity, inconsistent criteria for assigning species to schedules, and inadequate representation of narrowly endemic species significantly undermine their protection. Many high-priority species remain unlisted, leaving them vulnerable to threats like habitat loss and collection for trade. Kunte (2008) emphasizes the need for systematic analysis of invertebrate species' conservation values to improve their representation under the Act for the Act before the latest amendment but this, comment is valid for the 2022 iteration as well.

The placement of species under the schedules of the WPA, 1972, reflects the dynamic nature of conservation priorities in India, though the law fails to be dynamic. Gaps in the inclusion of invertebrates highlight areas that require immediate attention. Strengthening the scientific framework for assigning species to schedules and addressing these shortcomings will enhance the Act's impact, ensuring better conservation outcomes for India's rich biodiversity.

Conclusion

The evolution of wildlife protection laws in India highlights a journey shaped by socio-cultural values, colonial exploitation, and post-independence challenges. Pre-colonial conservation efforts were largely influenced by religious and cultural beliefs, with a deep connection to nature. During the colonial era, conservation became secondary to resource exploitation, as policies prioritized governance over ecological balance. However, post-independence India began to recognize the importance of biodiversity conservation, culminating in the establishment of the Wildlife Protection Act (WPA) of 1972. This Act introduced a legal framework for protection, providing schedules for species protection and formalizing the creation of protected areas. Over time, amendments to the WPA expanded its scope to address emerging conservation challenges. Notably, the 2006 amendment led to the formation of the National Tiger Conservation Authority, while the 2022 amendment aligned India's policies with global conservation agreements like CITES.

The WPA aimed to tackle a range of critical issues, such as poaching, habitat protection, scientific conservation, and community involvement. To address poaching and wildlife trade, the Act introduced stringent penalties and licensing mechanisms, while fostering the creation of national parks, wildlife sanctuaries, and conservation reserves. It also set provisions for species management and recovery. Over time, local communities have been gradually included in protection efforts, though their participation remains limited. Despite these strides, significant challenges persist. The centralization of decision-making under the WPA often limits local autonomy, creating inefficiencies in its implementation. Habitat fragmentation and increasing human-wildlife negative interactions continue to undermine conservation objectives. Furthermore, weak enforcement mechanisms and low conviction rates in wildlife trade cases hinder efforts to curtail illegal activities. The arbitrary classification of species in the WPA's schedules has also raised concerns about the lack of transparency and scientific rigor in conservation priorities. Additionally, overlaps between the WPA and other legislation, such as the Forest Rights Act, often complicate enforcement and implementation.

Several weaknesses in the implementation of the WPA worsen these challenges. Limited resources and inadequate capacity-building for enforcement agencies emasculate the Act's effectiveness. Ethical concerns, including the unregulated treatment of captive wildlife and the functioning of zoos, raise questions about the ethical foundations of conservation efforts. The static nature of the WPA also fails to address the evolving challenges in wildlife protection, necessitating a more dynamic approach to conservation.

The significant role of Indira Gandhi in shaping India’s wildlife protection policies and her leadership during the Stockholm Conference in 1972 marked a pivotal moment in the country’s conservation history. During the UN Conference on the Human Environment in Stockholm, Indira Gandhi emphasized the need for sustainable development and highlighted the importance of protecting India's biodiversity. This speech set the stage for the enactment of the Wildlife Protection Act later that year, signalling the beginning of a concerted effort to safeguard wildlife in India. Her leadership, coupled with the global environmental consciousness raised at the Stockholm Conference, brought international attention to India's biodiversity issues and catalysed the formulation of robust conservation laws.

To improve the effectiveness of wildlife protection in India, several key reforms are necessary. Empowering local authorities and communities through decentralized decision-making can ensure that conservation strategies are more inclusive and participatory. A focus on integrated landscape management would help ensure habitat connectivity and resilience, addressing issues of fragmentation. The scheduling process should be revised, incorporating clear scientific criteria to ensure that conservation priorities are set based on sound research. Investment in capacity-building for enforcement personnel is crucial to tackle challenges like poaching and habitat degradation. Legal integration, harmonizing the WPA with other environmental and social laws, would reduce contradictions and enhance governance. Finally, strengthening community engagement mechanisms can help ensure equitable benefit-sharing and foster long-term commitment to conservation.

In conclusion, while the Wildlife Protection Act and related policies have been instrumental in India’s efforts to protect its rich biodiversity, the dynamic nature of conservation challenges calls for a more adaptive, inclusive, and scientifically grounded approach. By addressing existing gaps and integrating ecological, social, and economic considerations, India can enhance its wildlife protection frameworks, ensuring that conservation efforts remain effective and sustainable for future generations.

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The Forgotten Few: Negotiating Space for the Invisible Mammals of India on the Wildlife (Protection) Act, 1972

Introduction

The Wildlife (Protection) Act, 1972, was a landmark piece of legislation in India, introduced following the Stockholm Conference to provide a legal framework for conserving species, establishing protected areas, and regulating activities that threaten biodiversity. Over the years, the Act has played a crucial role in safeguarding India's diverse wildlife.

In response to evolving conservation needs, the Act underwent a significant revision through the Wild Life (Protection) Amendment Act, 2022. This amendment reflects modern trends in biodiversity conservation aiming to strengthen protections through three key avenues: implementing India's commitments under CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), enhancing protections for native species, and strengthening law enforcement measures.

A notable aspect of this overhaul was the restructuring and reduction of the Act's schedules, streamlining them from six to four. The present Schedule I provides the highest level of protection and now includes 597 species of specially protected animals. Schedule II offers a comparatively lower degree of protection and covers 1,553 species. Schedule III lists 19 species and groups of specially protected plants (an increase from the previous six). Schedule IV focuses on regulating trade in species listed under CITES. This schedule is divided into three appendices: Appendix I contains 627 species, Appendix II with 497 species, and Appendix III with 217 species.

Although the recent amendments introduce several important improvements, the species lists within the schedules remain incomplete. Numerous species found in India are not included, leaving them without legal protection. This omission renders certain parts of the Act less effective, as many unlisted species face threats and require conservation measures. Addressing these gaps are essential to ensure the comprehensive protection of India's biodiversity.

We analyzed the mammalian species listed under Schedules I and II of the Wildlife (Protection) Act to identify species that have been excluded. This evaluation was carried out by referencing the Mammals of India database (Kunte & Bayani 2025), considering recent discoveries and species rediscoveries. The 228 species that have not been incorporated into the WPA are listed below.

This analysis reveals significant gaps in the current legislation, emphasizing the urgent need to update the schedules to align with the latest scientific discoveries and provide comprehensive protection for vulnerable species. Notably, even within the mammalian category, certain groups - such as bats, and arboreal and terrestrial forest rodents - are underrepresented.

A common misconception is that rodents, often generalized as 'rats,' lack conservation value. In reality, rodents represent a highly diverse group, with many species that are endemic, threatened, or

rare. These lesser-known species play critical roles in maintaining ecosystem balance, yet their absence from the schedules leaves them exposed to habitat loss, poaching, and other anthropogenic pressures. Similarly, recent research and field surveys have expanded our understanding of bat diversity and their geographic distribution. Bats contribute significantly to ecological functions such as pest control, seed dispersal, and pollination. However, the evolving knowledge of bat species and their conservation status is not adequately reflected in the current schedules.

Incorporating these findings into Schedules I and II of the Wildlife (Protection) Act is essential to ensure that conservation efforts extend beyond charismatic megafauna, encompassing all species vital to ecosystem health and resilience.

This update would represent a more holistic and science-driven approach to biodiversity conservation in India. As India marches forward in its conservation journey, expanding the scope of the Wildlife (Protection) Act to encompass a wider array of mammalian species is imperative. Ensuring that no species is left behind in legislative frameworks is not just a legal necessity but a moral obligation to preserve the rich biodiversity that defines the nation.

List of mammals:

The mammals are categorized alphabetically according to their order and family, including their scientific names, common names, and IUCN Red List status respectively.

Artiodactyla
Bovidae
1. *Naemorhedus caudatus* Milne-Edwards, 1867
Long-tailed Goral
Vulnerable
2. *Ovis orientalis* Gmelin, 1774
Ladakh Urial
Not Assessed

Artiodactyla
Cervidae
3. *Muntiacus gongshanensis* Ma, 1990
Gongshan Muntjac
Data Deficient
4. *Muntiacus muntjak* Zimmermann, 1780
Southern Red Muntjac
Least Concern

Artiodactyla
Delphinidae
5. *Delphinus capensis* Gray, 1828
Long-beaked Common Dolphin
Not Assessed
6. *Sousa plumbea* Gray, 1866
Indian Ocean Humpback Dolphin
Endangered

Carnivora
Mustelidae
7. *Mustela strigidorsa* Gray, 1853
Stripe-backed Weasel
Least Concern

Chiroptera
Emballonuridae
8. *Saccolaimus saccolaimus* Temminck, 1838
Bare-rumped Sheathtail-bat
Least Concern
9. *Taphozous longimanus* Hardwicke, 1825
Long-winged Tomb Bat
Least Concern
10. *Taphozous melanopogon* Temminck, 1841
Black-bearded Tomb Bat
Least Concern
11. *Taphozous nudiventris* Cretzschmar, 1830
Naked-rumped Tomb Bat
Least Concern
12. *Taphozous perforatus* E. Geoffroy, 1818
Egyptian Tomb Bat
Least Concern

13. *Taphozous theobaldi* Dobson, 1872
Theobald's Tomb Bat
Least Concern

Chiroptera
Hipposideridae
14. *Asellia tridens* E. Geoffroy, 1813
Geoffroy's Trident Leaf-nosed Bat
Least Concern
15. *Aselliscus stoliczkanus* Dobson, 1871
Stoliczka's Asian Trident Bat
Least Concern
16. *Coelops frithii* Blyth, 1848
Tailless Leaf-nosed Bat
Near Threatened
17. *Hipposideros armiger* Hodgson, 1835
Great Himalayan Leaf-nosed Bat
Least Concern
18. *Hipposideros ater* Templeton, 1848
Dusky Leaf-nosed Bat
Least Concern
19. *Hipposideros cineraceus* Blyth, 1853
Least Leaf-nosed Bat
Least Concern
20. *Hipposideros diadema* E. Geoffroy, 1813
Diadem Leaf-nosed Bat
Least Concern
21. *Hipposideros fulvus* Gray, 1838
Fulvus Leaf-nosed Bat
Least Concern

22. *Hipposideros galeritus* Cantor, 1846
Cantor's Leaf-nosed Bat
Least Concern
23. *Hipposideros lankadiva* Kelaart, 1850
Kelaart's Leaf-nosed Bat
Least Concern
24. *Hipposideros larvatus* Horsfield, 1823
Horsfield's Leaf-nosed Bat
Least Concern
25. *Hipposideros nicobarulae* Miller, 1902
Nicobar Leaf-nosed Bat
Endangered
26. *Hipposideros pomona* K. Andersen, 1918
Andersen's Leaf-nosed Bat
Endangered
27. *Hipposideros speoris* Schneider, 1800
Schneider's Leaf-nosed Bat
Least Concern

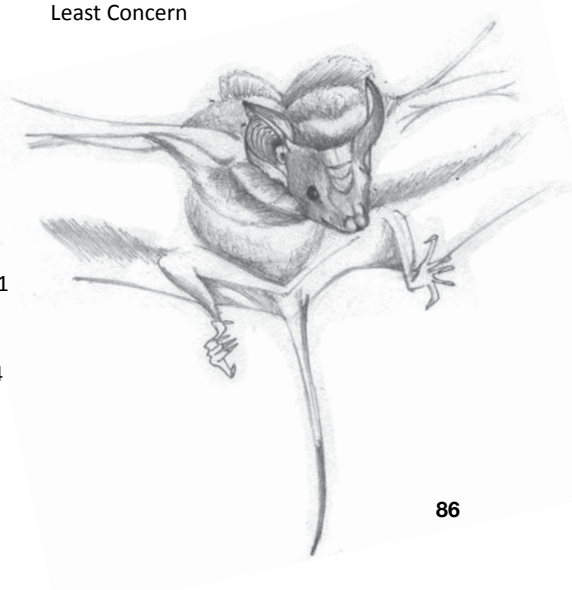
Chiroptera
Miniopteridae
28. *Miniopterus fuliginosus* Hodgson, 1835
Eastern Bent-winged Bat
Not assessed
29. *Miniopterus magnater* Sanborn, 1931
Large Bent-winged Bat
Least Concern
30. *Miniopterus pusillus* Hollister, 1913
Small Long-fingered Bat
Least Concern

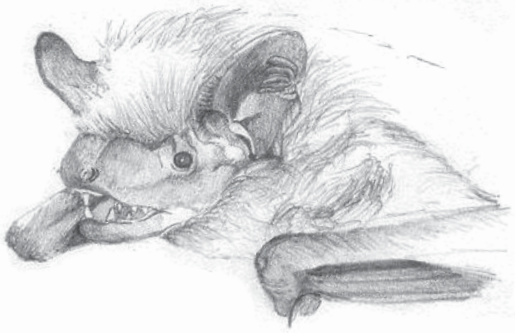
Chiroptera
Molossidae
31. *Chaerephon plicatus* Buchannan, 1800
Wrinkle-lipped Free-tailed Bat
Least Concern
32. *Tadarida aegyptiaca* E. Geoffroy, 1818
Egyptian Free-tailed Bat
Least Concern
33. *Tadarida teniotis* Rafinesque, 1814
European Free-tailed Bat
Least Concern

Chiroptera
Pteropodidae
34. *Cynopterus brachyotis* Müller, 1838
Lesser Dog-faced Fruit Bat
Least Concern
35. *Cynopterus sphinx* Vahl, 1797
Greater Short-nosed Fruit Bat
Least Concern
36. *Eonycteris spelaea* Dobson, 1871
Cave Nectar Bat (Dawn Bat)
Least Concern
37. *Macroglossus sobrinus* K. Andersen, 1911
Hill Long-tongued Fruit Bat
Least Concern
38. *Megaerops niphanae* Yenbutra & Felten, 1983
Ratanaworabhan's Fruit Bat
Least Concern
39. *Pteropus hypomelanus* Temminck, 1853
Island Flying Fox
Near Threatened
40. *Rousettus leschenaultii* Desmarest, 1820
Leschenault's Rousette
Near Threatened
41. *Sphaerias blanfordi* Thomas, 1891
Blandford's Fruit Bat
Least Concern

Chiroptera
Rhinolophidae
42. *Rhinolophus affinis* Horsfield, 1823
Intermediate Horseshoe Bat
Least Concern
43. *Rhinolophus beddomei* K. Andersen, 1905
Beddome's Horseshoe Bat
Least Concern
44. *Rhinolophus ferrumequinum* Schreber, 1774
Greater Horseshoe Bat
Least Concern
45. *Rhinopoma hardwickii* Gray, 1831
Lesser Mouse-tailed Bat
Least Concern
46. *Rhinolophus hipposideros* Bechstein, 1800
Lesser Horseshoe Bat
Least Concern
47. *Rhinolophus lepidus* Blyth, 1844
Blyth's Horseshoe Bat
Least Concern
48. *Rhinolophus luctus* Temminck, 1834
Woolly Horseshoe Bat
Least Concern
49. *Rhinolophus macrotis* Blyth, 1844
Big-eared Horseshoe Bat
Least Concern
50. *Rhinopoma microphyllum* Brünnich, 1782
Greater Mouse-tailed Bat
Least Concern
51. *Rhinopoma muscatellum* Thomas, 1903
Small Mouse-tailed Bat
Least Concern
52. *Rhinolophus pearsonii* Horsfield, 1851
Pearson's Horseshoe Bat
Least Concern
53. *Rhinolophus pusillus* Temminck, 1834
Least Horseshoe Bat
Least Concern
54. *Rhinolophus rouxii* Temminck, 1835
Rufous Horseshoe Bat
Least Concern
55. *Rhinolophus shortridgei* K. Andersen, 1918
Shortridge's Horseshoe Bat
Data Deficient
56. *Rhinolophus siamensis* Gyldenstolpe, 1917
Thai Horseshoe Bat
Least Concern
57. *Rhinolophus sinicus* K. Andersen, 1905
Chinese Horseshoe Bat
Least Concern
58. *Rhinolophus subbadius* Blyth, 1844
Little Nepalese Horseshoe Bat
Least Concern
59. *Rhinolophus trifoliatus* Temminck, 1834
Trefoil Horseshoe Bat
Near Threatened
60. *Rhinolophus yunanensis* Dobson, 1872
Dobson's Horseshoe Bat
Least Concern

Chiroptera
Vespertilionidae
61. *Arielulus circumdatus* Temminck, 1840
Bronze Sprite
Least Concern
62. *Barbastella leucomelas* Cretzschmar, 1826
Eastern Barbastelle
Least Concern
63. *Eptesicus bottae* (Eydoux and Gervais), 1836
Botta's Serotine
Least Concern
64. *Eptesicus gobiensis* Bobrinskii, 1926
Gobi Big Brown Bat
Least Concern
65. *Eptesicus pachyotis* Dobson, 1871
Thick-eared Bat
Least Concern
66. *Eptesicus serotinus* Schreber, 1774
Serotine
Least Concern
67. *Falsistrellus affinis* Dobson, 1871
Chocolate Pipistrelle
Least Concern





68. *Harpiocephalus harpia* Temminck, 1840
Lesser Hairy-winged Bat
Least Concern
69. *Hesperoptenus tickelli* Blyth, 1851
Tickell's Bat
Least Concern
70. *Hypsugo cadornae* Thomas, 1916
Cadorna's Pipistrelle
Least Concern
71. *Hypsugo joffrei* Thomas, 1913
Joffre's Pipistrelle
Data Deficient
72. *Hypsugo savii Bonaparte*, 1837
Savi's Pipistrelle
Least Concern
73. *Ia io* Thomas, 1902
Great Evening Bat
Near Threatened
74. *Keirvoula hardwickii* Horsfield, 1824
Hardwicke's Woolly Bat
Not assessed
75. *Kerivoula kachinensis* Bates, Struebig, Rossiter, Kingston, Sia Sein Lein Oo & Khin Mya Mya, 2004
Kachin Woolly Bat
Least Concern
76. *Kerivoula lenis* Thomas, 1916
Lenis Woolly Bat
Least Concern
77. *Kerivoula papillosa* Temminck, 1840
Papillose Woolly Bat
Least Concern
78. *Kerivoula picta* Pallas, 1767
Painted Woolly Bat
Near Threatened
79. *Murina aurata* Milne-Edwards, 1872
Little Tube-nosed Bat
Data Deficient
80. *Murina cyclotis* Dobson, 1872
Round-eared Tube-nosed Bat
Least Concern
81. *Murina huttoni* Peters, 1872
Hutton's Tube-nosed Bat
Least Concern
82. *Murina jaintiana* Ruedi, Biswas & Csorba, 2012
Jaintia Tube-nosed Bat
Data deficient
83. *Murina leucogaster* Milne-Edwards, 1872
Rufous Tube-nosed Bat
Least Concern
84. *Murina tubinaris* Scully, 1881
Scully's Tube-nosed Bat
Data Deficient
85. *Myotis annectans* Dobson, 1871
Hairy-faced Bat
Least Concern
86. *Myotis blythii* Tomes, 1857
Lesser Mouse-eared Bat
Least Concern
87. *Myotis daubentonii* Kuhl, 1817
Daubenton's Bat
Least Concern
88. *Myotis formosus* Hodgson, 1835
Hodgson's Bat
Near Threatened
89. *Myotis hasseltii* Temminck, 1840
Hasselt's Bat
Least Concern
90. *Myotis horsfieldii* Temminck, 1840
Horsfield's Bat
Least Concern
91. *Myotis longipes* Dobson, 1873
Kashmir Cave Bat
Data Deficient
92. *Myotis muricola* Gray, 1846
Nepalese Whiskered Bat
Least Concern
93. *Myotis mystacinus* Kuhl, 1817
Whiskered Bat
Least Concern
94. *Myotis peytoni* Wroughton and Ryley, 1913
Peyton's Whiskered Bat
Data Deficient
95. *Myotis sicarius* Thomas, 1915
Mandelli's Mouse-eared Bat
Vulnerable
96. *Myotis siligorensis* Horsfield, 1855
Siliguri Bat
Least Concern
97. *Nyctalus leisleri* Kuhl, 1817
Lesser Noctule
Least Concern
98. *Nyctalus montanus* Barrett-Hamilton, 1906
Mountain Noctule
Least Concern
99. *Nyctalus noctula* Schreber, 1774
Common Noctule
Least Concern
100. *Otonycteris hemprichii* Peters, 1859
Hemprich's Long-eared Bat
Least Concern
101. *Pipistrellus abramus* Temminck, 1838
Japanese Pipistrelle
Least Concern
102. *Pipistrellus ceylonicus* Kelaart, 1852
Kelaart's Pipistrelle
Least Concern
103. *Pipistrellus coromandra* Gray, 1838
Indian Pipistrelle
Least Concern
104. *Pipistrellus kuhlii* Kuhl, 1817
Kuhl's Pipistrelle
Least Concern
105. *Pipistrellus javanicus* Gray, 1838
Javan Pipistrelle
Least Concern
106. *Pipistrellus paterculus* Thomas, 1915
Mount Popa Pipistrelle
Least Concern
107. *Pipistrellus pipistrellus* Schreber, 1774
Common Pipistrelle
Least Concern
108. *Pipistrellus tenuis* Temminck, 1840
Indian Pygmy Bat
Least Concern
109. *Plecotus homochrous* Hodgson, 1847
Long-eared Bat
Data Deficient
110. *Plecotus wardii* Thomas, 1911
Long-eared Bat
Least Concern
111. *Scotozous dormeri* Dobson, 1875
Dormer's Bat
Least Concern
112. *Scotophilus heathii* Horsfield, 1831
Greater Yellow House Bat
Least Concern
113. *Scotophilus kuhlii* Leach, 1821
Lesser Yellow House Bat
Least Concern
114. *Scotoecus pallidus* Dobson, 1876
Yellow Desert Bat
Least Concern
115. *Scotomanes ornatus* Blyth, 1851
Harlequin Bat
Least Concern
116. *Tylonycteris malayana* Chasen, 1940
Malayan Flat-headed Bat
Not assessed
117. *Tylonycteris pachypus* Temminck, 1840
Lesser Bamboo Bat
Least Concern
118. *Tylonycteris robustula* Thomas, 1915
Greater Flat-headed Bat
Least Concern
119. *Vespertilio murinus* Linnaeus, 1758
Parti-coloured Bat
Least Concern

Eulipotyphia
Talpidae
120. *Euroscaptor micrura* Hodgson, 1841
Short-tailed Mole
Least Concern
121. *Parascaptor leucura* Blyth, 1850
White-tailed Mole
Least Concern

Legomorpha
Leporidae
122. *Lepus capensis* Linnaeus, 1758
Cape Hare
Least Concern

Legomorpha
Ochotonidae
123. *Ochotona curzoniae* Hodgson, 1857
Plataeu Pika
Least Concern

124. *Ochotona forresti* Thomas, 1923
Forrest's Pika
Least Concern
125. *Ochotona ladacensis* Günther, 1875
Ladakh Pika
Least Concern
126. *Ochotona macrotis* Günther, 1875
Large-eared Pika
Least Concern
127. *Ochotona nubrica* Thomas, 1922
Nubra Pika
Least Concern
128. *Ochotona sikimaria* Thomas, 1922
Sikkim Pika
Not assessed
129. *Ochotona thibetana* Milne-Edwards, 1871
Moupin's Pika
Least Concern

Primata
Cercopithecidae
130. *Macaca fascicularis* Raffles, 1821
Long-tailed Macaque
Endangered
131. *Macaca mulatta* Zimmermann, 1780
Rhesus Macaque
Least Concern

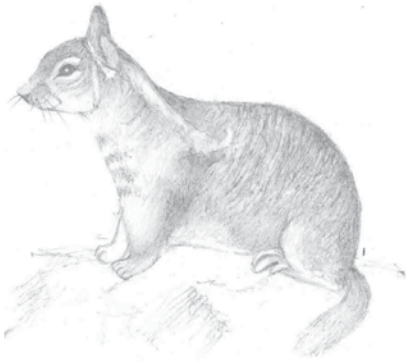
Rodentia
Cricetidae
132. *Alticola albicauda* True, 1894
White-tailed Mountain Vole
Data Deficient
133. *Alticola argentatus* Severtzov, 1879
Silvery Mountain Vole
Least Concern
134. *Alticola montosa* TRUE, 1894
Central Kashmir Vole
Vulnerable
135. *Alticola stoliczkanus* Blanford, 1875
Stoliczka's Mountain Vole
Least Concern
136. *Cricetulus alticola* Thomas, 1917
Ladakh Hamster
Least Concern
137. *Cricetulus migratorius* Pallas, 1773
Grey Hamster
Least Concern
138. *Eothenomys melanogaster* Milne-Edwards, 1871
Pere David's Red-backed Vole
Least Concern
139. *Hyperacrius fertilis* TRUE, 1894
Sub-alpine Kashmir Vole
Near Threatened
140. *Hyperacrius wynnei* Blanford, 1881
Coniferous Kashmir Vole
Least Concern
141. *Neodon sikimensis* Horsfield, 1841
Sikkim Mountain Vole
Least Concern
142. *Phaiomys leucurus* Blyth, 1863
Blyth's Mountain Vole
Least Concern
143. *Phodopus roborovskii* Satunin, 1903
Desert Hamster
Least Concern

Rodentia
Muridae
144. *Apodemus draco* Barrett-Hamilton, 1900
South China Field Mouse
Least Concern
145. *Apodemus pallipes* Barrett-Hamilton, 1900
Himalayan Field Mouse
Least Concern
146. *Apodemus rusiges* Miller, 1913
Kashmir Field Mouse
Least Concern
147. *Apodemus sylvaticus* Linnaeus, 1758
Long-tailed Field Mouse
Least Concern
148. *Bandicota bengalensis* Gray, 1835
Lesser Bandicoot Rat
Least Concern
149. *Bandicota indica* Bechstein, 1800
Greater Bandicoot Rat
Least Concern
150. *Berylmys manipulus* Thomas, 1916
Manipur White-toothed Rat
Data Deficient
151. *Berylmys bowersi* Anderson, 1879
Bower's white-toothed Rat
Least Concern
152. *Berylmys mackenziei* Thomas, 1916
Kenneth's White-toothed Rat
Data Deficient
153. *Chiropodomys gliroides* Blyth, 1856
Pencil-tailed Tree Mouse
Least Concern
154. *Dacnomys millardi* Thomas, 1916
Millard's Large-toothed Rat
Data Deficient

155. *Diomys crumpi* Thomas, 1917
Crump's Mouse
Data Deficient
156. *Gerbillus gleadowi* Murray, 1886
Little Indian Hairy-footed Gerbil
Least Concern
157. *Gerbillus nanus* Blanford, 1875
Pygmy Gerbil
Least Concern
158. *Golunda ellioti* Gray, 1837
Indian Bush Rat
Least Concern
159. *Leopoldamys edwardsi* Thomas, 1882
Edward's Noisy Rat
Last Concern
160. *Madromys blanfordi* Thomas, 1881
White-tailed Wood Rat
Least Concern
161. *Meriones hurrianae* Jordon, 1867
Indian Desert Jird
Least Concern
162. *Micromys minutus* Pallas, 1771
Harvest Mouse
Least Concern
163. *Millardia meltada* Gray, 1837
Soft-furred Field Rat
Least Concern
164. *Millardia gleadowi* Murray, 1885
Sand-coloured Rat
Least Concern
165. *Mus booduga* Gray, 1837
Little Indian Field Mouse
Least Concern
166. *Mus cervicolor* Hodgson, 1845
Fawn-coloured Mouse
Least Concern
167. *Mus cookii* Ryley, 1914
Cooke's Mouse
Least Concern
168. *Mus musculus* Linnaeus, 1758
House Mouse
Least Concern
169. *Mus pahari* Thomas, 1916
Sikkim Mouse
Least Concern

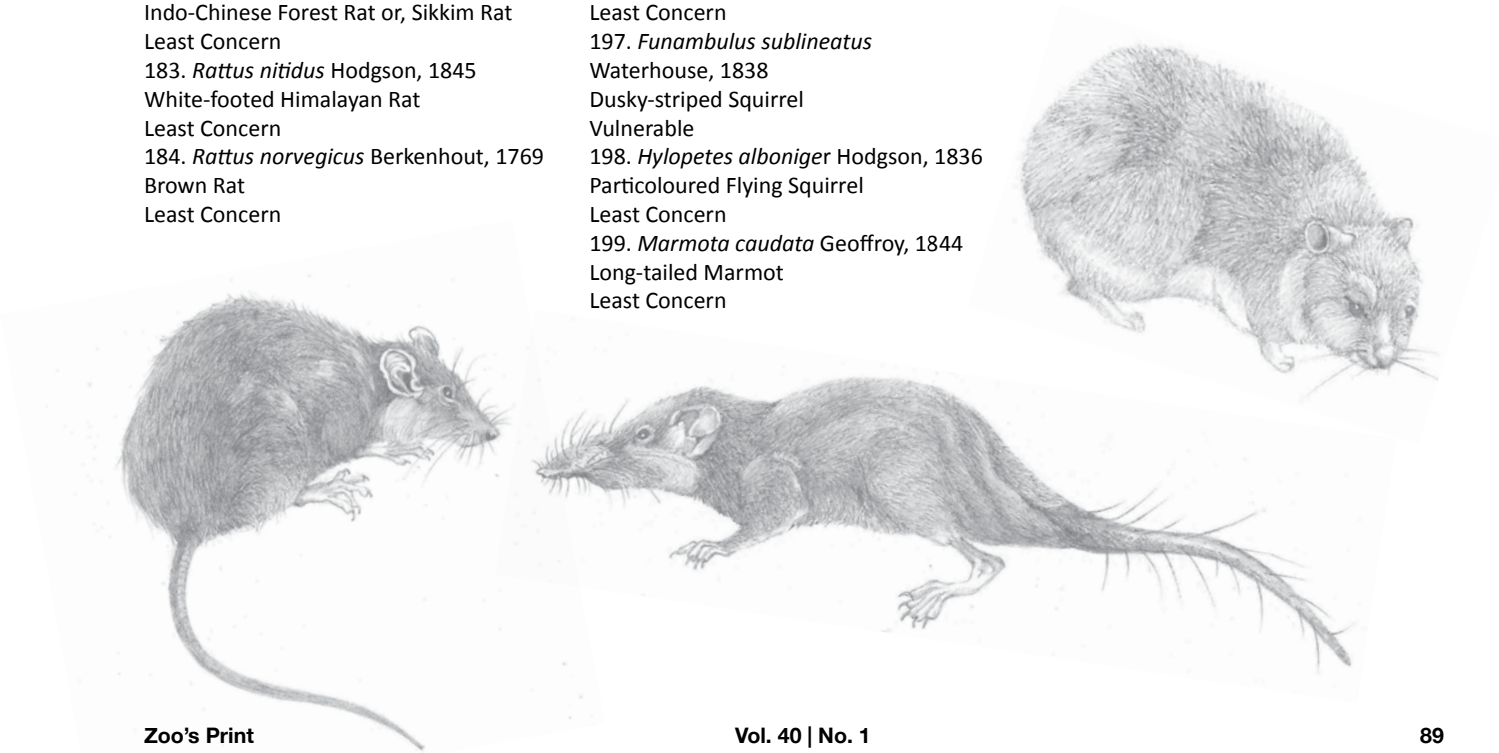
170. *Mus platythrix* Bennett, 1832
Spiny Field Mouse
Least Concern
171. *Mus phillipsi* Wroughton, 1912
Wroughton's Mouse
Least Concern
172. *Mus saxicola* Elliot, 1839
Elliot's Brown Spiny Mouse
Least Concern
173. *Mus terricolor* Blyth, 1851
Pygmy Field Mouse
Least Concern
174. *Nesokia indica* Gray, 1830-1835
Short-tailed Bandicoot Rat
Least Concern
175. *Niviventer brahma* Thomas, 1914
Mishmi Rat
Least Concern
176. *Niviventer confucianus* Milne-Edwards, 1871
Chinese White-bellied Rat or, Confucian Rat
Least Concern
177. *Niviventer eha* Wroughton, 1916
Smoke-bellied Rat
Least Concern
178. *Niviventer fulvescens* Gray, 1847
Chestnut Rat or, Chestnut White-bellied Rat
Least Concern
179. *Niviventer langbianis* Robinson and Kloss, 1922
Lang Bian White-bellied Rat
Least Concern
180. *Niviventer niviventer* Hodgson, 1836
White-bellied Rat
Least Concern
181. *Niviventer tenaster* Thomas, 1916
Tenasserim White-bellied Rat or, Tenasserim Rat
Least Concern
182. *Rattus andamanensis* Blyth, 1860
Indo-Chinese Forest Rat or, Sikkim Rat
Least Concern
183. *Rattus nitidus* Hodgson, 1845
White-footed Himalayan Rat
Least Concern
184. *Rattus norvegicus* Berkenhout, 1769
Brown Rat
Least Concern
185. *Rattus pyctoris* Hodgson, 1845
Himalayan Rat
Least Concern
186. *Rattus rattus* Linnaeus, 1758
Black Rat, House Rat, Roof Rat, or Ship rat
Least Concern
187. *Rattus tanezumi* Temminck, 1844
Asian House Rat
Least Concern
188. *Tatera indica* (Hardwicke, 1807)
Indian Gerbil
Least Concern
189. *Vandeleuria oleracea* Bennett, 1832
Asiatic Long-tailed Climbing Mouse
Least Concern

Rodentia
Sciuridae
190. *Callosciurus erythraeus* Pallas, 1779
Pallas's Squirrel
Least Concern
191. *Callosciurus pygerythrus* Geoffroy Saint Hilaire, 1833
Hoary-bellied Squirrel
Least Concern
192. *Dremomys pernyi* Milne-Edwards, 1867
Perny's Long-nosed Squirrel
Least Concern
193. *Dremomys rufigenis* Blanford, 1878
Asian Red-cheeked Squirrel
Least Concern
194. *Eoglaucomys fimbriatus* Gray, 1837
Kashmir Flying Squirrel
Least Concern
195. *Funambulus palmarum* Linnaeus, 1766
Three-striped Palm Squirrel
Least Concern
196. *Funambulus pennantii* Wroughton, 1905
Five-striped Palm Squirrel
Least Concern
197. *Funambulus sublineatus* Waterhouse, 1838
Dusky-striped Squirrel
Vulnerable
198. *Hylopetes alboniger* Hodgson, 1836
Particoloured Flying Squirrel
Least Concern
199. *Marmota caudata* Geoffroy, 1844
Long-tailed Marmot
Least Concern



200. *Marmota himalayana* Hodgson, 1841
Himalayan Marmot
Least Concern
201. *Petaturista mechukaensis* Choudhury, 2007
Mechuka Giant Flying Squirrel
Not assessed
202. *Petaurista mishmiensis* Choudhury, 2009
Mishmi Giant Flying Squirrel
Near Threatened
203. *Tamiops macclellandi* Horsfield, 1839
Himalayan Striped Squirrel
Least Concern
Rodentia
Sminthidae
204. *Sicista concolor* Büchner, 1892
Chinese Birch Mouse
Least Concern

Rodentia
Spalacidae
205. *Cannomys badius* Hodgson, 1841
Lesser Bamboo Rat
Least Concern
206. *Rhizomys pruinosus* Blyth, 1851
Hoary Bamboo Rat
Least Concern



Scandentia
Soricidae
207. *Chimarrogale himalayica* Gray, 1842
Himalayan Water Shrew
Least Concern
208. *Crocidura attenuata* Milne-Edwards, 1872
Grey Shrew
Least Concern
209. *Crocidura fuliginosa* Blyth, 1855
Southeast Asian Shrew
Least Concern
210. *Crocidura horsfieldii* Tomes, 1856
Horsfield's Shrew
Data Deficient
211. *Crocidura pergrisea* Miller, 1913
Pale Grey Shrew
Data Deficient
212. *Crocidura pullata* Miller, 1911
Kashmir White-toothed Shrew
Data Deficient
213. *Crocidura suaveolens* Pallas, 1811
Lesser White-toothed Shrew
Least Concern
214. *Crocidura zarudnyi* Ognev,1928
Zarudny's Rock Shrew
Least Concern
215. *Episoriculus caudatus* Horsfield, 1851
Hodgson's Brown-toothed Shrew
Least Concern
216. *Episoriculus leucops* Horsfield, 1855
Indian Long-tailed Shrew
Least Concern
217. *Episoriculus macrurus* Blanford, 1888
Blanford's Long-tailed Shrew
Least Concern
218. *Feroculus feroculus* Kelaart, 1850
Kelaart's Long-clawed Shrew
Endangered
219. *Nectogale elegans* Milne-Edwards, 1870
Elegant Water Shrew
Least Concern
220. *Sorex minutus* Linnaeus, 1766
Eurasian Pygmy Shrew
Least Concern
221. *Sorex planiceps* Miller, 1911
Kashmir Shrew
Least Concern
222. *Sorex thibetanus* Kastschenko, 1905
Tibetan Shrew
Data Deficient
223. *Soriculus nigrescens* Gray, 1842
Sikkim Large-clawed Shrew
Least Concern
224. *Suncus etruscus* Savi, 1822
Pygmy White-toothed Shrew
Least Concern
225. *Suncus murinus* Linnaeus, 1766
House Shrew
Least Concern
226. *Suncus niger* Horsfield, 1851
Hill Shrew
Not assessed
227. *Suncus stoliczkanus* Anderson, 1877
Anderson's Shrew
Least Concern

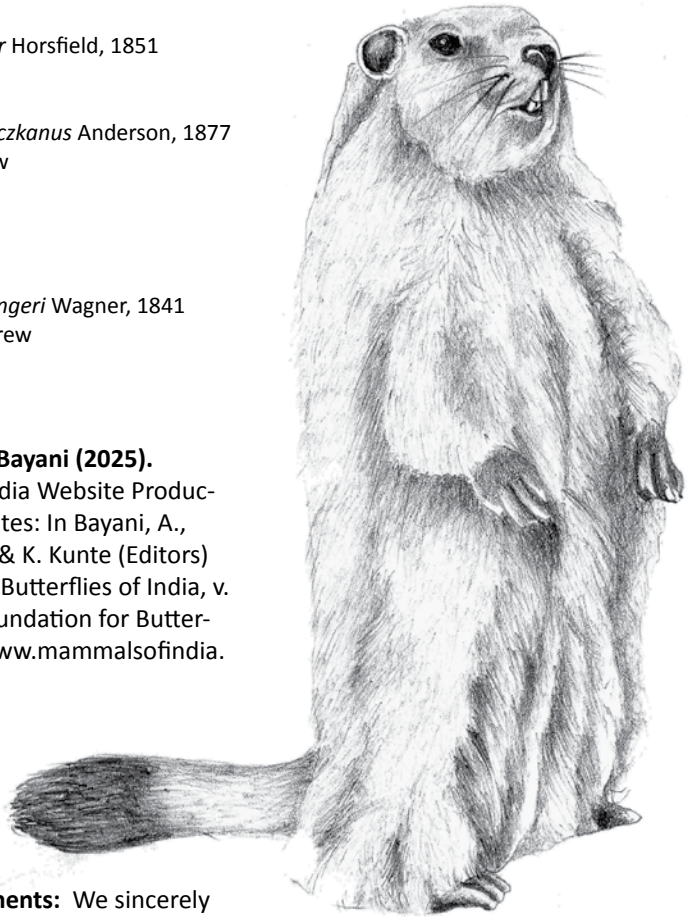
Scandentia
Tupaiidae
228. *Tupaia belangeri* Wagner, 1841
Northern Treeshrew
Least Concer

Reference

Kunte, K. & A. Bayani (2025). Mammals of India Website Producers and Associates: In Bayani, A., R. Chakravarty & K. Kunte (Editors) (Chief Editors). Butterflies of India, v. 1.13. Indian Foundation for Butterflies. https://www.mammalsofindia.org/producers

Acknowledgements: We sincerely thank the Ram Hattikudur Advanced Training in Conservation course at Zoo Outreach Organisation for allowing us to contribute to the list. This experience allowed us to identify knowledge gaps, reflect on our interpretations, and better understand the complexities of listing and conserving mammals. It has been instrumental in preparing us for the challenges we will face as budding conservationists.

Himangshu Kalita, Diya Banerjee, Mohsin Ahmad & Shivangi Kanwar Chouhan, RHATC Fellows 2024–25, Zoo Outreach Organisation, Coimbatore, Tamil Nadu, India.



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Mapping the Rocky Outcrops of India

Introduction

Rocky outcrops are unique and rugged landscapes that stand out amidst other ecosystems due to their distinct geological formations and ecological significance. They often harbour endemic and highly specialized species, making them critical to conservation efforts. In India, these formations include inselbergs, lateritic plateaus, and other rocky landscapes that are scattered across the subcontinent.

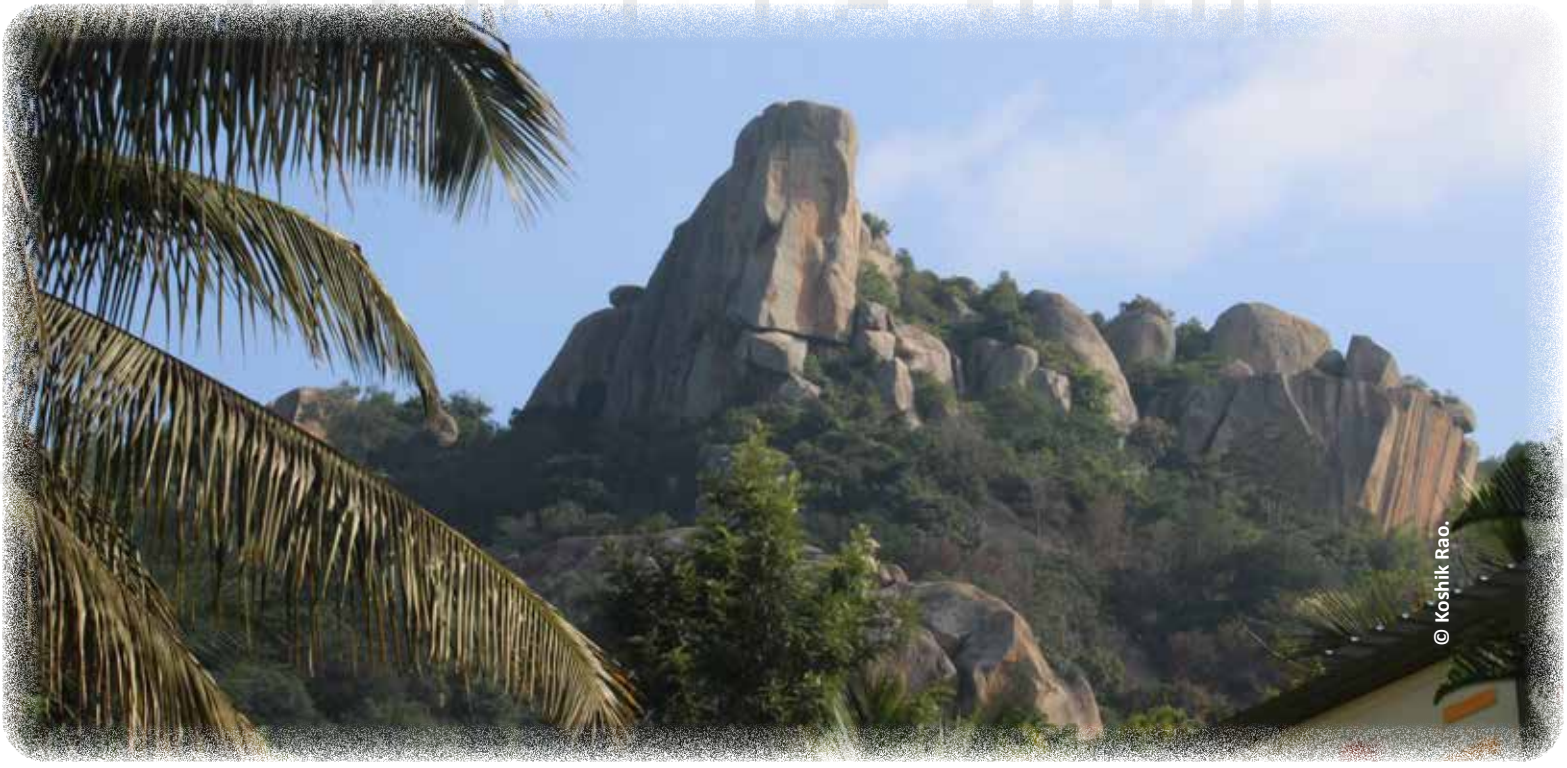
As part of the 2024–25 Ram Hattikudur Advanced Training in Conservation (RHATC), the theme focuses on "Rocky Outcrops and Inselbergs" highlighting their importance as ecological and geological treasures. With a specific focus on the lateritic plateaus of Maharashtra, this year's mentorship emphasizes understanding their biodiversity, threats, and conservation needs. Following a session with Dr. Aparna Watve, we were introduced to the significance of lateritic plateaus in the Konkan region. This inspired us to undertake a mapping exercise to better understand the distribution of rocky outcrops across India.

Mapping the Rocky Outcrops of India

The mapping exercise aimed to document the distribution of rocky outcrops across India and to give us an introduction to the topic in a relaxed way. The study revealed a wide variety of rocky landscapes, each associated with specific geological formations and ecological systems. Moreover, we found that these ecosystems are found to be distributed all over India. However, the presence of rocky Outcrops in western Himalayas is still under debate, so we have excluded this region but included northeastern Himalayas. In the Himalaya, it is still debated about the presence of Rocky outcrops, so we have excluded northern Himalaya from our study.

The mapping exercise not only introduced us to the diversity and distribution of these rocky landscapes but also underscored their ecological importance and the threats they face due to mining, urbanization, and agricultural expansion.

This exercise was instrumental in providing a foundational understanding of rocky outcrops, preparing us for further exploration and detailed studies on the lateritic plateaus of Maharashtra under the RHATC mentorship program.



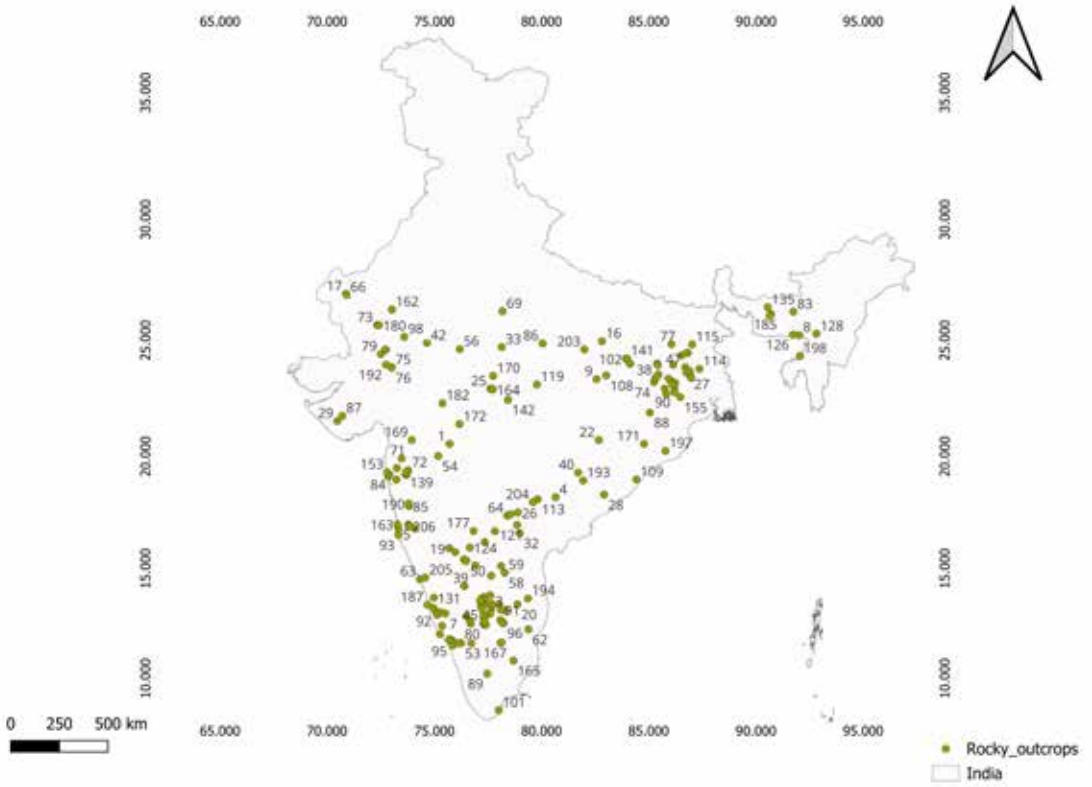


Fig 1. Map showing rocky outcrops of India.

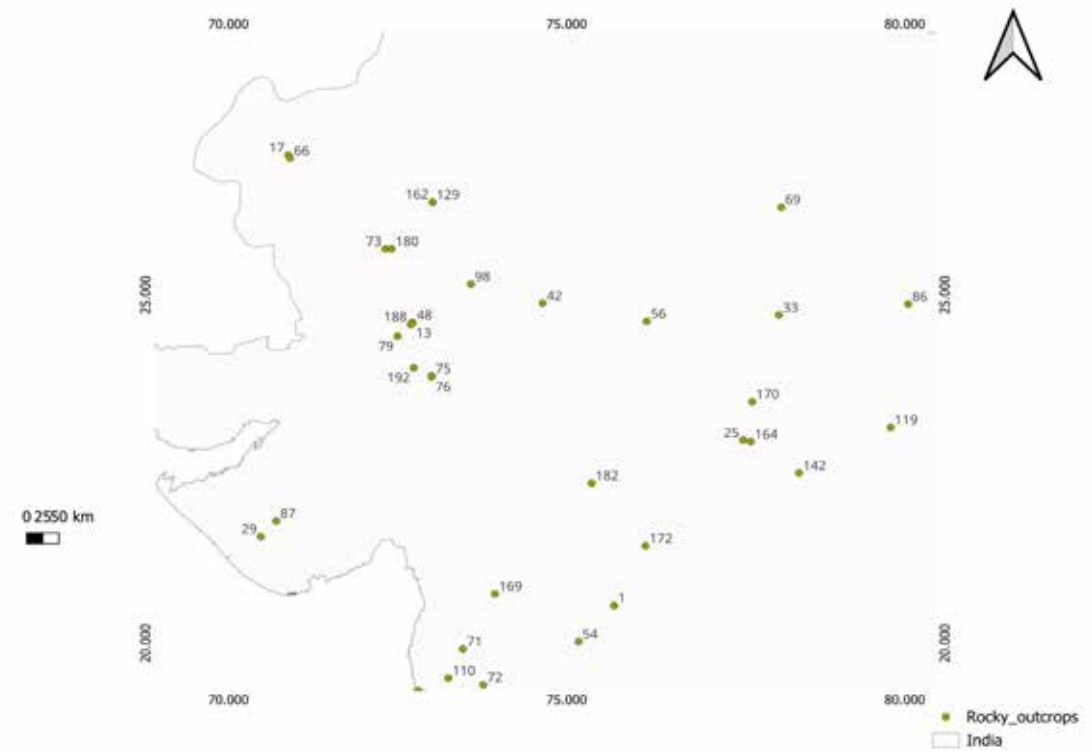


Fig 2. Enlarged map showing rocky outcrops of western and central India.

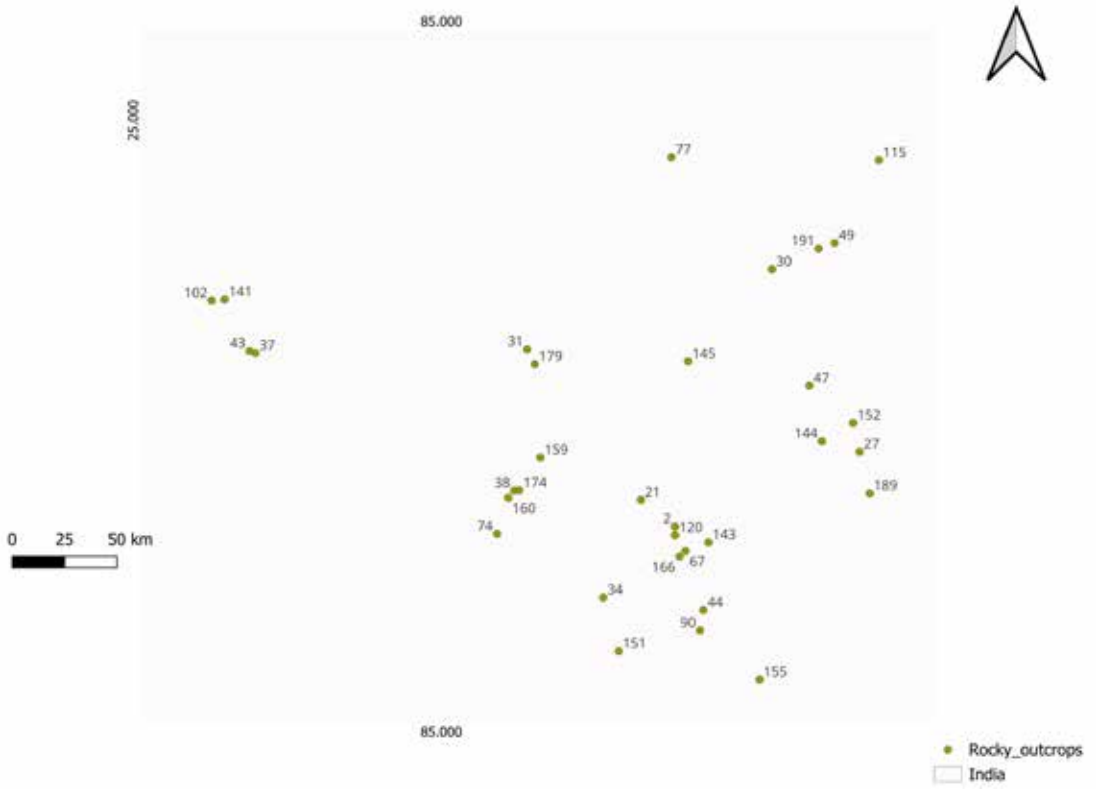


Fig 3. Enlarged map showing rocky outcrops of eastern coastal India.

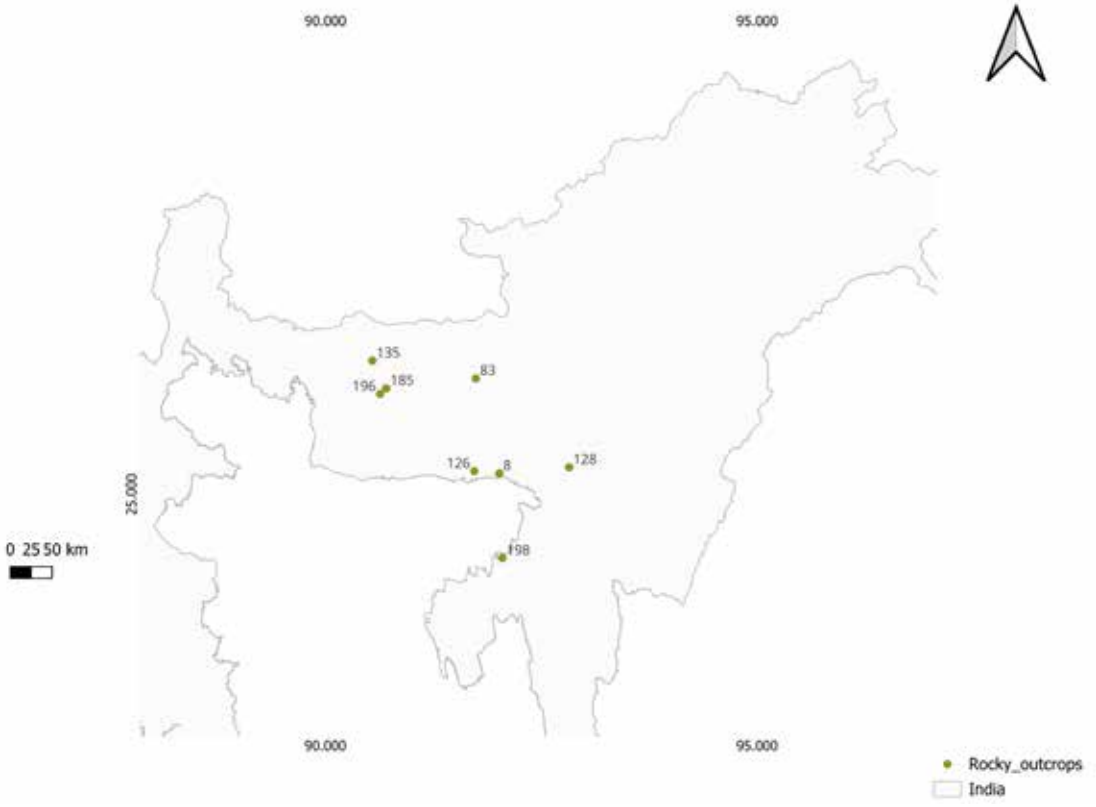


Fig 4. Enlarged map showing rocky outcrops of northeastern India.

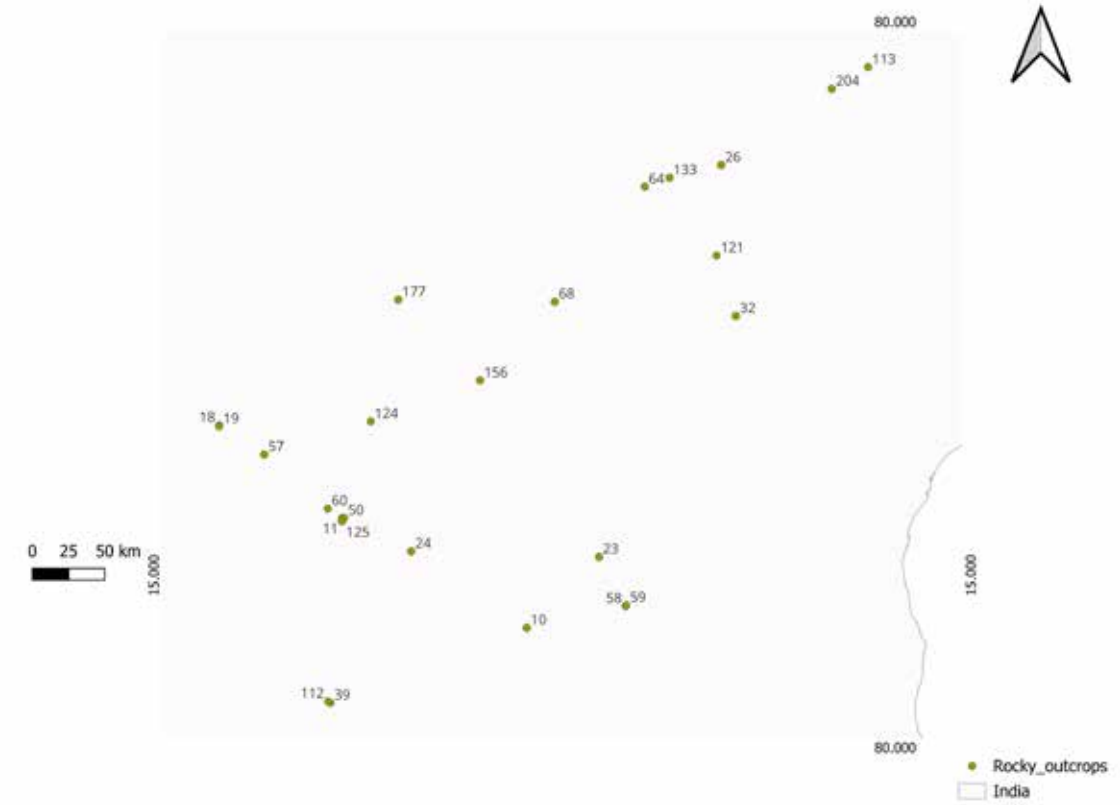


Fig 5. Enlarged map showing rocky outcrops of Southern part of central India.

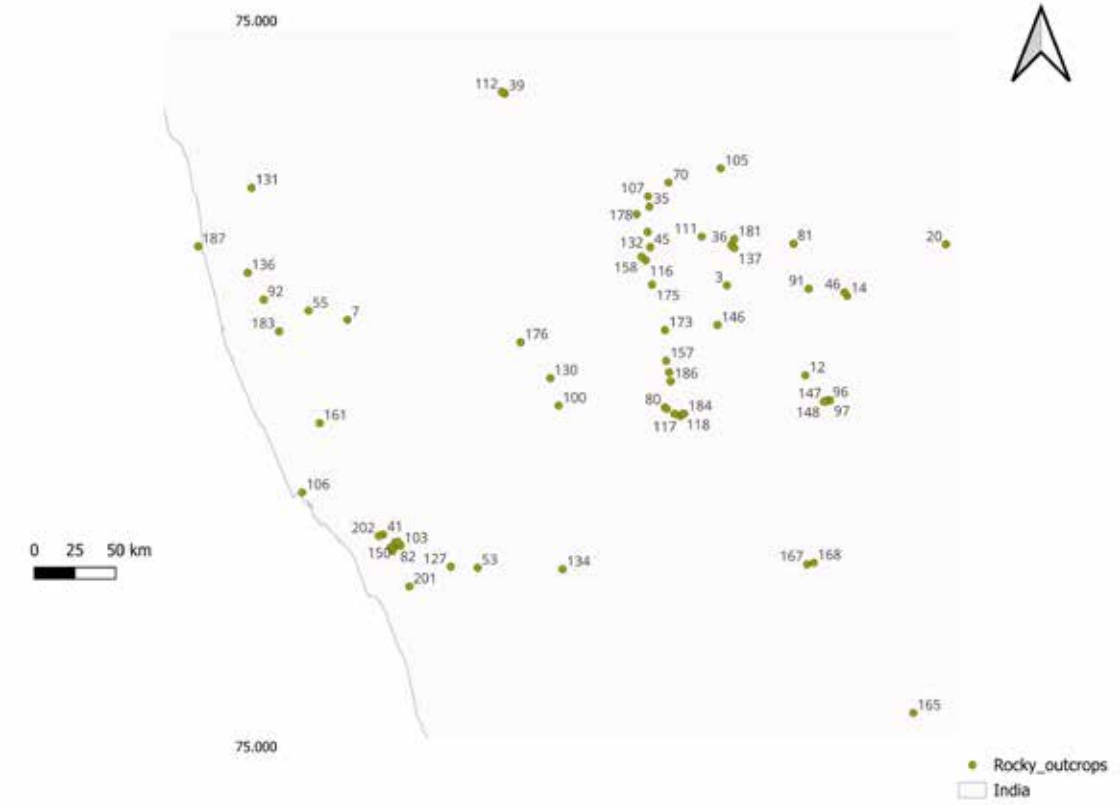


Fig 6. Enlarged map showing rocky outcrops of Konkan coastal region and central India.

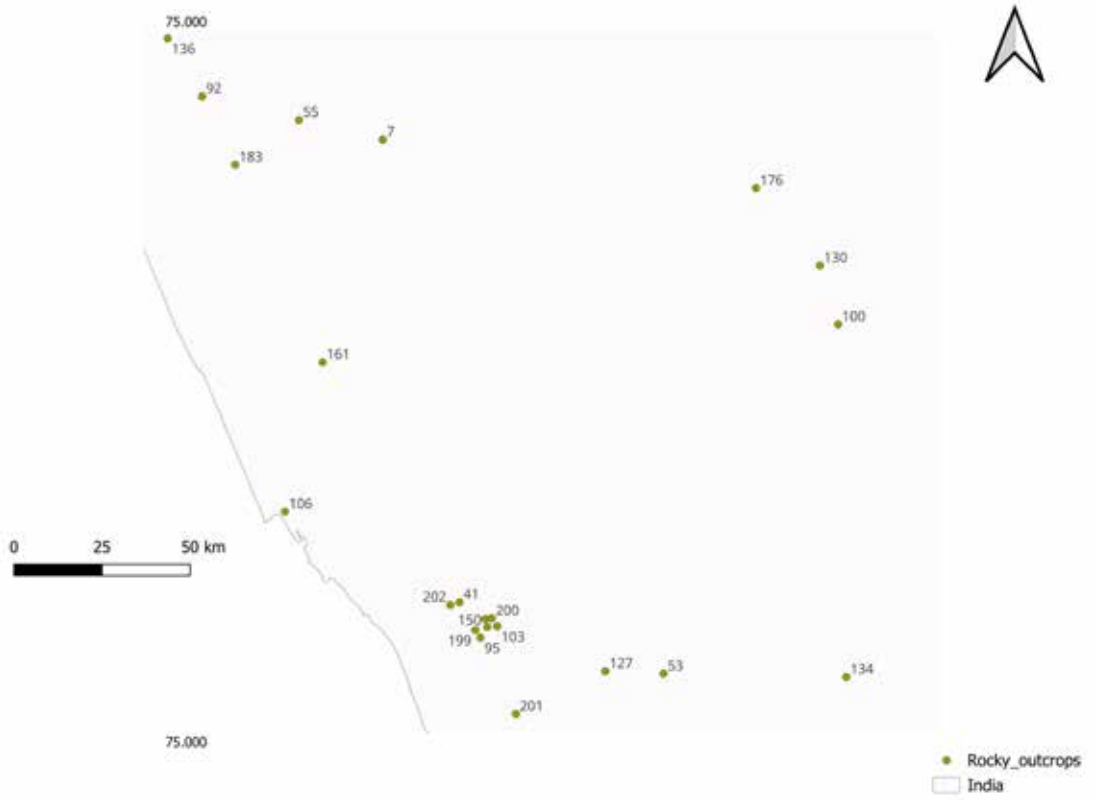


Fig 7. Enlarged map showing rocky outcrops of Konkan coastal region.

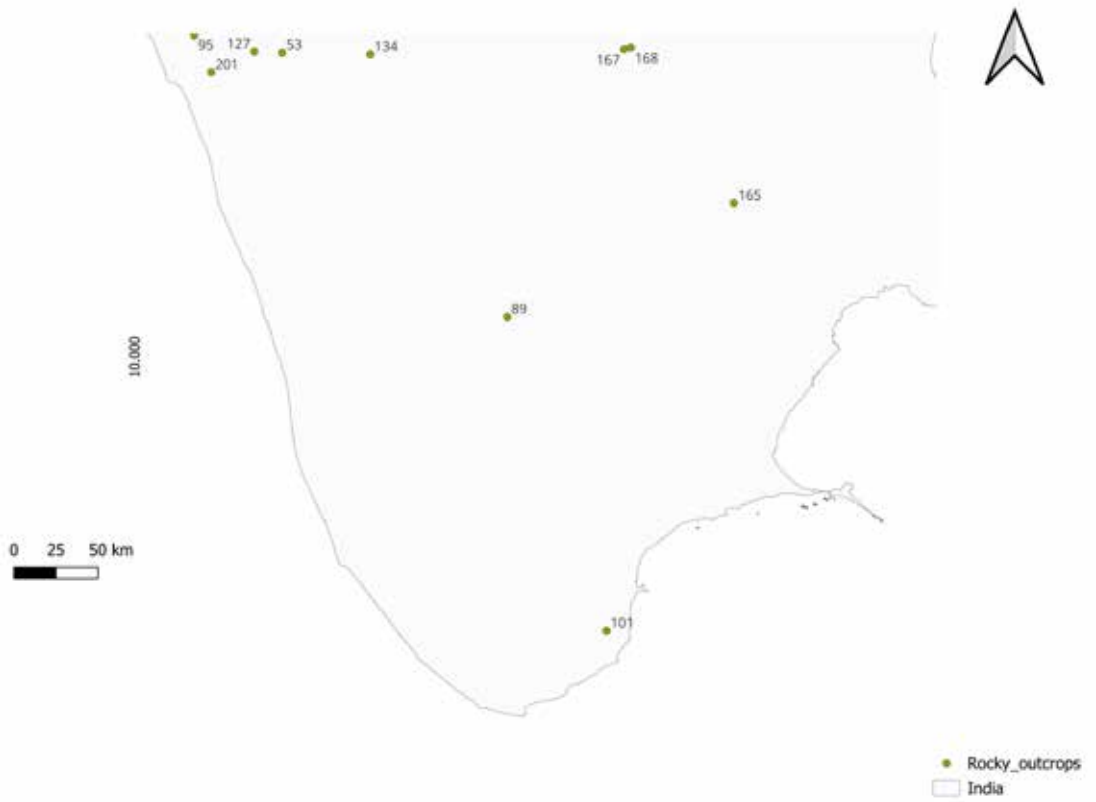


Fig 8. Enlarged map showing rocky outcrops of southern India.

Table: List of the out crops are given in the end

	Place Name	Latitude	Longitude
1	Ajanta Caves	20.5514	75.7033
2	Ajodhya Hill	23.25048	86.08442
3	Akkayamma Betta	13.16589	77.64321
4	Albaka	18.1972	80.6571
5	Amba Plateau location 1	16.985	73.784
6	Amba Plateau location 2	16.987	73.7970E
7	Amedikallu	12.97785	75.51226
8	Amkoi	25.22107	92.01495
9	Amritdhara Falls	23.3471	82.5684
10	Anantapur	14.6759	77.6474
11	Anjanadri Hill	15.35461	76.46989
12	Ankushagiri Fort	12.67392	78.08434
13	Arbuda Devi Temple	24.60475	72.71292
14	Avani Betta	13.10777	78.3186
16	Baba Sidhbath Dari	24.96417	82.82167
17	Bada Bagh	26.95514	70.88773
18	Badami Fort	15.92313	75.68421
19	Badami South Fort and Caves	15.91728	75.68483
20	Bala Raya Konda Durgam	13.39	78.8731
21	Bansa Hill	23.36644	85.92616
22	Bargarh Upland	20.7225	82.67306
23	Belam caves	15.113	78.109
24	Bellary Fort	15.14761	76.91026
25	Bhimbetka Rock Shelters	22.9392	77.6111
26	Bhongir Fort	17.515	78.888
27	Biharinath Hill	23.57477	86.94055
28	Borra Caves	18.3151	82.9211
29	Buddhist Caves of Khapra Kodiya	21.55073	70.48049
30	Burhai Hill	24.36212	86.5342
31	Canary Hill	24.0169	85.39833
32	Chandampet	16.5938	78.9816
33	Chanderi	24.7184	78.1377
34	Chandil-Gamharia Range	22.94253	85.75146
35	Channarayana Durga	13.59509	77.20782
36	Chennagiri-Channakeshava Betta	13.38632	77.66791
37	Chianki Hill	24.00073	84.138
38	Chiraundi Hill	23.40676	85.33725
39	Chitradurga Fort	14.21127	76.39459
40	Chitrakote Falls	19.2887	81.7037
41	Chittari Mala	11.80046	75.71216
42	Chittor Fort	24.88398	74.64737
43	Chiyanki Hill	24.00988	84.11013

	Place Name	Latitude	Longitude
44	Dalma Hill Top	22.8891	86.21591
45	Devarayanadurga Hill	13.37393	77.2126
46	Devarayasamudra Betta	13.12796	78.30384
47	Dharampur Hil	23.85994	86.7079
48	Dilwara Temple	24.60963	72.72299
49	Dumka road	24.47453	86.8247
50	Durga Temple and Vali Cave	15.35416	76.48127
51	Durgawadi Plateau location 1	19.19389	73.69516
52	Durgawadi Plateau location 2	19.21766	73.64276
53	Edakkal caves	11.61862	76.24381
54	Ellora Caves	20.024	75.179
55	Gadaikallu (Jamalabad Fort)	13.02744	75.29398
56	Gagron Fort	24.62801	76.18603
57	Gajendragad	15.74381	75.97158
58	Gandikota Fort	14.81	78.28
59	Gandikota Gorge	14.8156	78.2812
60	Gandugali Kumara Ramana Hill	15.41108	76.37759
61	Gillbert Hill	19.1206	72.8402
62	Gingee Fort	12.25	79.39
63	Gokarna	14.52248	74.31585
64	Golconda Fort	17.3833	78.4011
65	Golconda Fort	17.3833	78.4011
66	Golden Fort	26.91248	70.91259
67	Gorgaburu Hill	23.14441	86.13291
68	Guddeguda	16.68069	77.82587
69	Gwalior Fort	26.231	78.173
70	Handi Gundi Betta	13.72618	77.31529
71	Harihar Fort	19.91639	73.46694
72	Harishchandragad	19.3913	73.7675
73	Hinglaj Mata Mandir	25.65	72.32
74	Huringdag Hill	23.21852	85.25837
75	Idar Fort	23.85296	73.00534
76	Idar Hill Fort	23.83943	73.00075
77	Jamui Hill Range	24.84245	86.06759
78	Jenvadekal Betta	12.46212	77.34958
79	Jessore Sloth Bear Sanctuary	24.41709	72.49939
80	Kabbaladurga	12.49779	77.29479
81	Kailasagiri Betta	13.39345	78.01721
82	Kammayi	11.73755	75.78466
83	Kanai Boroxi Boa Rocks	26.21139	91.74316
84	Kanheri Caves	19.2	72.9
85	Kas Plateau	17.8003	73.814
86	Ken River, Raneh	24.87	80.05
87	Khambhalida Buddhist Caves	21.77687	70.70897

	Place Name	Latitude	Longitude
88	Khandadhar Falls	21.916	85.06
89	Kodaikanal Pillar Rocks	10.2133	77.4631
90	Koel River Basin	22.8	86.2
91	Kolar	13.14658	78.10209
92	Konaje Kallu	13.08762	75.04168
93	Konkan Region 1	16.51667	73.31667
94	Konkan Region 2	16.8	73.31667
95	Koranappara	11.71053	75.76651
96	Krishnagiri	12.5381	78.21415
97	Krishnagiri Fort	12.5364	78.2217
98	Kumbhalgarh Fort	25.15331	73.58684
99	Kunagalu Betta	12.68962	77.31834
100	Kunti Betta	12.5082	76.69806
101	Kuthiraimozhi	8.5367	78
102	Kuthiwala Hill	24.22714	83.93457
103	Kuttiady Ghat	11.73954	75.81029
104	Lakshmi Venkataramana Betta	12.48927	77.30634
105	Lepakshi Rock Formations	13.8042	77.6087
106	Madayippara	12.03155	75.25762
107	Madhugiri Fort	13.65194	77.20036
108	Mahanadi Basin	23.50639	83.02306
109	Mahendragiri	18.9856	84.43
110	Mahuli Fort	19.49083	73.24972
111	Makalidurga Fort	13.43193	77.50104
112	Malappanahatty	14.22085	76.38029
113	Mallampalli	18.1106	79.8257
114	Mama Bhagne Hill	23.78528	87.37208
115	Manadar Hill	24.83	87.03
116	Mandaragiri Hill	13.30241	77.18721
117	Marale Hebbarga Betta	12.45065	77.3818
118	Marammana Betta	12.46161	77.39314
119	Marble Cliffs, Jabalpur	23.12	79.79
120	Marble Lake	23.21324	86.08489
121	Marrigudda	16.9627	78.85869
123	Masai plateau	16.81778	74.07833
124	Maski	15.94751	76.65174
125	Matanga hills	15.33161	76.46834
126	Mawsmai Caves	25.24476	91.72406
127	Mayiladippara	11.62433	76.09203
128	Megalithic Stone Jars	25.28513	92.82351
129	Mehrangarh Fort	26.29917	73.01795
130	Melukote	12.65822	76.65114
131	Metkalgudde Shri Mahaganapati temple	13.69803	74.97309
132	Minchukallu Betta	13.45747	77.19715

	Place Name	Latitude	Longitude
133	Moula Ali Hill	17.4369	78.5583
134	Moyar Gorge	11.61	76.72
135	Nakkati Hills	26.39586	90.54442
136	Nakre Rock Hill	13.23462	74.95209
137	Nandi Hills	13.36955	77.68481
138	Naneghat Plateau location 1	19.27934	73.68888
139	Naneghat Plateau location 2	19.29814	73.67399
141	Pachghra Hill	24.23224	83.99479
142	Pachmarhi Hills	22.4674	78.4346
143	Pakhi Pahar	23.18189	86.23973
144	Panchkot Hill	23.62096	86.7655
145	Pareshnath Hill	23.96491	86.14466
146	Peninsular Gneiss Lalbagh	12.94869	77.58966
147	Perumal Temple	12.5314	78.1956
148	Perumal Temple Krishnagiri	12.52949	78.1874
149	Prabalgad fort	18.9804	73.2217
150	Pullippara	11.75781	75.77928
151	Purulia 1	22.70972	85.82361
152	Purulia 2	23.7	86.91028
153	Querry site	19.30546	72.79456
155	Raghunathdi	22.58531	86.47682
156	Raichur Fort Hill	16.19898	77.34927
157	Ramadevara Hills	12.75308	77.30267
158	Ramadeverabetta	13.32179	77.16416
159	Ramgarh Hill	23.54992	85.45917
160	Ranchi Hill	23.3752	85.31071
161	Ranipuram	12.4121	75.35562
162	Rao Jodha Desert Rock Park	26.30507	73.0167
163	Ratandurga Fort	16.99611	73.27
164	Ratapani Wildlife Sanctuary	22.9178	77.7223
165	Rock Fort	10.82	78.69
166	Rocky Island	23.1196	86.10451
167	Salem 1	11.6372	78.0942
168	Salem 2	11.6461	78.1311
169	Salher Fort	20.72	73.94
170	Sanchi Stupa	23.486	77.7422
171	Satkosia Gorge	20.5531	84.786
172	Satpura Range	21.4167	76.1667
173	Savandurga Hill	12.92092	77.29506
174	Shanti Hill	23.408	85.36204
175	Shivaganga Hills	13.16925	77.22302
176	Shravanabelagola	12.85449	76.48459
177	Siddalingeshwara Betta	16.6926	76.82751
178	Siddarabetta	13.55446	77.13577

	Place Name	Latitude	Longitude
179	Sitagarh Hill	23.9529	85.43369
180	Siwana Fort	25.65	72.41
181	Skandagiri Hills	13.41754	77.68377
182	Songarh Fort	22.32	75.37
183	Sri Karinjeshwara Temple	12.91407	75.12788
184	Sri Muneshwara Betta	12.46337	77.4033
185	Sri Surya Pahar	26.10847	90.70322
186	SRS Hills	12.64021	77.32683
187	St. Mary's Islands	13.37791	74.67299
188	Sunset Point	24.58539	72.69502
189	Susunia Hill	23.39445	86.98741
190	Tableland Plateau	17.92	73.8
191	Tapovan Hill	24.45126	86.75132
192	Taranaga Caves	23.97	72.74
193	Tirathgarh Falls	18.9383	81.9436
194	Tirumala Hills	13.6596	79.3621
195	Toad Rock	24.59302	72.70305
196	Tukreswari Temple	26.04956	90.63217
197	Udayagiri and Khandagiri Caves	20.246	85.7869
198	Unakoti	24.33074	92.05043
199	Urithookki	11.72962	75.7534
200	Vaalook	11.7595	75.79581
201	Vayalada	11.51552	75.8591
202	Vazhamala	11.79384	75.68842
203	Vindhya	24.6167	82
204	Warangal Fort	17.9784	79.5941
205	Yana Rocks	14.59026	74.56723
206	Zenda Plateau Location 1	16.918	73.797
207	Zenda Plateau Location 2	16.904	73.849

Sidharthan, Koshik V Rao, Dupati Poojitha, Anandita Pascal, Diya Banerjee, Gupta Priya, Himangshu Kalita, Jain Zeal, Mohsin Ahmad & Shivangi Kanwar Chouhan
RHATC Fellows 2024–25, Zoo Outreach Organisation, Coimbatore, Tamil Nadu, India.


NATIVE
Plants that have evolved naturally in an area for a long time without being introduced by humans.
NATIVE PLANTS OF COIMBATORE PLAINS
Limonia acidissima (விளாம் பழம்)
It bears aromatic edible fruits which are used as a souring agent. The tree is also drought-tolerant.
Albizia lebbeck (வாகை)
It bears fragrant flowers and golden-brown pods that glimmer during spring and summer seasons. Its seed pods moving in the wind sound like rainfall. All tree parts have medicinal uses.
Butea monosperma (புரசு)
It is a medium-sized tree, which is drought-tolerant. It has ornamental value because of its beautiful bright-orange flowers.
Bauhinia purpurea (ஆத்தி)
It is a large shrub or medium tree, providing ample amount of shade. The flowers are large, showy and fragrant.
CHOOSE NATIVE TREES
They support local biodiversity, conserve water, improve soil health, reduce invasive species, enhance climate resilience.
Native Plant Nursery in Coimbatore Plains
Zoo Outreach Organisation Nursery, Srivari Illam, 61, Karthik Nagar, Saravanampatti, Coimbatore, Tamil Nadu 641035.
Email: zooreach@zooreach.org
Created by: Koshik V Rao, Jain Zeal, Anandhitha Pascal, Himangshu Kalita, and Diya Banerjee
Pongamia pinnata (புங்கை)
It is a medium-sized evergreen tree bearing purple-pink flowers. The seeds are rich in oil.
Bombax ceiba (இலவு)
It is a large deciduous tree with a broad canopy. It bears beautiful red flowers and fiber-rich seed pods.
BOSCH
zoOreach
Zoo Outreach Organisation

NATIVE PLANTS
PRIDE OF COIMBATORE PLAINS

Cordia diffusa

- *Cordia diffusa* is a rare endemic plant and highly threatened.
- It is found only in Coimbatore plains.
- Yellowish-white flowers
- Flowering occurs in Feb-Jun.
- Flowers are small and closely-clustered.
- Propagation: Stem-cuttings.

WHAT CAN YOU DO TO SAVE THE PRIDE OF COIMBATORE PLAINS?
Learn about & become aware of the native plants of Coimbatore plains.

If you find any of these native plants, send us a photo and keep the local biodiversity thriving and alive.

Zoo Outreach Organisation nursery, Srivari Illam, 61, Karthik Nagar, Saravanampatti, Coimbatore, Tamil Nadu 641035.
Email: zooreach@zooreach.org

SAY NO TO NON NATIVE,
AND
YES TO NATIVE BIODIVERSITY

Created by: Koshik V Rao, Jain Zeal, Ananditha Pascal, Himangshu Kalita, and Diya Banerjee

Caralluma bicolor

- *Caralluma bicolor* is found in the foothills of Western Ghats and Coimbatore plains.
- Beautiful greenish-yellow flowers with reddish-brown striations.
- Flowering and fruiting occurs in Aug-Dec.
- Uses: The whole plant is used as a vegetable by the tribals of Attappadi.
- Propagation: Seeds and stem cutting.

CSR initiative by BOSCH

zooreach
Zoo Outreach Organisation

Advanced Training in Conservation

MISS KERALA (DENISON'S BARB) THREATS AND CONSERVATION

Denison's Barb, also known as the Miss Kerala, is a native colorful fish of freshwater rivers of India that flows particularly in the Western Ghats of Kerala and Karnataka.

Water pollution.
Habitat loss.

THREAT

Illegal pet trade.

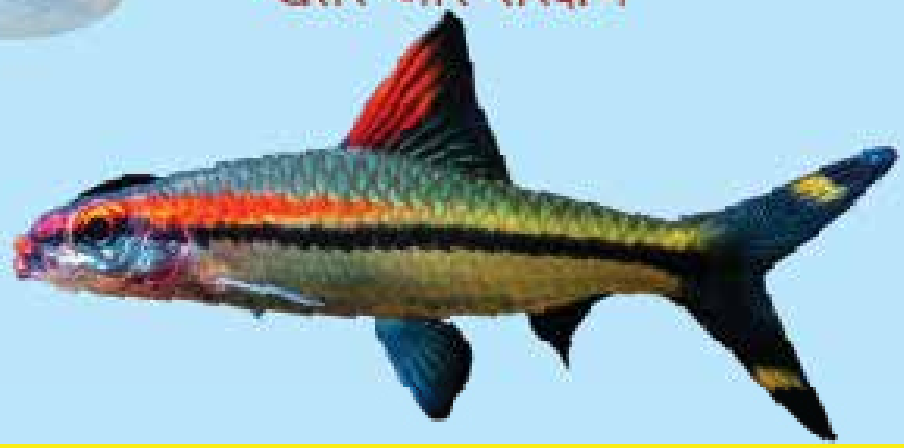
Overfishing.

WHAT YOU CAN DO TO HELP DENISE AND HER FRIENDS ?

- Support captive bred aquarium pet trade
- Educate Others
- Participate in Clean-up Initiatives

Created by Dupati Poojitha, Mohsin Ahmad and Shivangi Kanwar Chouhan

मिस केरला: डेनिसन्स बार्ब
खतरे और संरक्षण



डेनिसन्स बार्ब, जिसे मिस केरला के नाम से भी जाना जाता है, जो ताज़े पानी की एक रंगीन मछली है। यह मछली भारत की नदियों, विशेष रूप से केरला और कर्नाटका के पश्चिमी घाटों में पाई जाती है। इसकी सुंदरता और जीवंत रंग इसे जलीय एक्वेरियम के लिए बहुत लोकप्रिय बनाते हैं।

जल प्रदूषण, आवास का नुकसान

खतरा

अवैध पालतू व्यापार

अत्यधिक मछली पकड़ना

आप डेनिस और उसके दोस्तों की मदद के लिए क्या कर सकते हैं ?

- कैप्टिव ब्रीड एक्वेरियम पालतू व्यापार का समर्थन करें |
- पर्यावरण संरक्षण और एक्वेरियम पालतू व्यापार के प्रभावों के बारे में दूसरों को जानकारी दें |
- स्थानीय जलाशयों और नदियों की सफाई के लिए सामुदायिक अभियानों में भाग लें |

Created by Dupati Poojitha, Mohsin Ahmad and Shivangi Kanwar Chouhan

മിസ്സ് കേരള (ഡെനിസൺസ് ബാർബ്) നേരിടുന്ന ഭീഷണികളും സംരക്ഷണവും

മിസ് കേരള എന്നറിയപ്പെടുന്ന ഡെനിസൺസ് ബാർബ് കേരളത്തിലെയും കർണാടകത്തിലെയും പടിഞ്ഞാറോട്ട് ഒഴുകുന്ന പശ്ചിമഘട്ട നദികളിൽ മാത്രം കാണപ്പെടുന്ന ഒരു വർണ്ണാഭമായ ശുദ്ധജല മത്സ്യമാണ്

ജലമലിനീകരണം

ആവാസവ്യവസ്ഥയുടെ നഷ്ടം

നേരിടുന്ന ഭീഷണികൾ

അനധികൃത വളർത്തുമൃഗ വ്യാപാരം

അമിത മത്സ്യബന്ധനം

ഡെനിസിനെയും അവന്റെ സുഹൃത്തുക്കളെയും നിങ്ങൾക്ക് എങ്ങനെ സഹായിക്കാം?

- കൃത്രിമ ബ്രീഡ് അക്വേറിയം വ്യാപാരത്തെ പിന്തുണയ്ക്കുക.
- മറ്റുള്ളവരെ ബോധവൽകരിക്കുക
- ശുചീകരണ സംരംഭങ്ങളിൽ പങ്കാളിയാവുക

Created by Dupati Poojitha, Mohsin Ahmad and Shivangi Kanwar Chouhan


MISS KERALA
Western Ghat's living Rainbow
zoOreach
Advanced Training in Conservation
Found in westflowing freshwater rivers of Kerala and Karnataka
DID YOU KNOW?
Denisonii is nicknamed "Miss Kerala" for her beauty and significance to Kerala's freshwater ecosystems.
Sahyadria denisonii
(Red-lined Torpedo Barb)
HOW DOES SHE LOOK?
• Grows 6-8 cm in length, known for its vibrant colors: a prominent red stripe from nose to mid-body, silver sides, and black line across its body making it popular in the aquarium trade.
FOUND ONLY IN - WEST FLOWING RIVERS OF WESTERN GHATS
• Chalakkudy River
• Pamba River
• Periyar River
• Chaliyar River
• Valapattanan River
• Anjarikkandy River
• Netravati River
PROBLEMS AND SOLUTIONS
• Categorised as 'Endangered' (IUCN) due to habitat destruction-sand mining, pollution from pesticides, and overfishing for the aquarium trade.
• Conservation efforts focus on regulating trade, protecting habitats, and awareness campaigns.
DUPATI POOJITHA, SIDHARTHAN, GUPTA PRIYA, SHIVANGI KANWAR CHOUHAN AND MOHSIN AHMAD (RHATC 2024-25)

മിസ്സ് കേരള

പശ്ചിമ ഘട്ടത്തിന്റെ റാണി

കേരളത്തിലെയും കർണാടകയിലെയും പടിഞ്ഞാറോട്ട് ഒഴുകുന്ന ശുദ്ധജല നദികളിൽ കാണപ്പെടുന്നു

നിങ്ങൾക്കറിയാമോ??

ഡെനിസോണിയുടെ ഭംഗിയും കേരളത്തിന്റെ ശുദ്ധജല ആവാസ വ്യവസ്ഥയിൽ ഇവൾക്കുള്ള പ്രാധാന്യവും കണക്കിലെടുത്താണ് ഇവളെ മിസ്സ് കേരള എന്ന് വിളിക്കുന്നത്

സഹ്യാദ്രിയ ഡെനിസോണി
(ചോരക്കണിയാൻ)

എങ്ങനെ തിരിച്ചറിയാം?

- 6-8 സെന്റീമീറ്റർ നീളത്തിൽ വളരുന്ന ഇവ ഊഷ്മളമായ നിറങ്ങൾക്ക് പേരുകേട്ടതാണ്: മൂക്ക് മുതൽ ശരീരത്തിന്റെ മധ്യഭാഗം വരെയുള്ള ചുവന്ന വര, വെള്ളി വശങ്ങൾ, ശരീരത്തിന് കുറുകെയുള്ള കറുത്ത വര എന്നിവ അക്വേറിയം വ്യാപാരത്തിൽ ഇവരെ ഏറെ ജനപ്രിയരാക്കുന്നു.

പടിഞ്ഞാറോട്ട് ഒഴുകുന്ന പശ്ചിമഘട്ട ശുദ്ധജല നദികളിൽ മാത്രം കാണപ്പെടുന്നു

- ചാലക്കുടി പുഴ
- പമ്പ നദി
- പെരിയാർ
- ചാലിയാർ
- വളപട്ടണം പുഴ
- അഞ്ചരക്കണ്ടി പുഴ
- നേത്രാവതി നദി

എന്നെ സംരക്ഷിക്കൂ!!

- മണൽ ഖനനം, കീടനാശികളിൽ നിന്നുള്ള മലിനീകരണം എന്നിവ മൂലമുള്ള ആവാസവ്യവസ്ഥയുടെ നാശം, അക്വേറിയം വ്യാപാരത്തിനായുള്ള അമിത മത്സ്യബന്ധനം എന്നിവ കാരണം 'വംശനാശ ഭീഷണി' നേരിടുന്നതായി (IUCN) വർഗീകരിച്ചിരിക്കുന്നു.
- ബോധവൽക്കരണ ക്യാമ്പയിനുകൾ വഴി കൂടുതൽ ആളുകളെ ഇതിന്റെ സംരക്ഷണത്തിലേക്ക് ആകർഷിക്കുക, വ്യാപാര നിയന്ത്രണം കൊണ്ടുവരിക, ആവാസ വ്യവസ്ഥകൾ സംരക്ഷിക്കുക തുടങ്ങിയവ ആണ് നമുക്കിനി ചെയ്യാൻ ഉള്ളത്.

DUPATI POOJITHA, SIDHARTHAN, GUPTA PRIYA , SHIVANGI KANWAR CHOUHAN AND MOHSIN AHMAD (RHATC 2024-25)

1 Toxic Medications

In addition to diclofenac, other veterinary NSAIDs like ketoprofen and aceclofenac are legally used in India, posing a toxic threat to vultures, harming their survival.

2 Habitat Loss & Degradation

Vulture populations are plummeting due to habitat loss, deforestation, forest fires, quarrying, and disturbances to rocky cliffs. These threats disrupt vulture nesting sites and endanger their breeding grounds.

3 Infectious Decline

Vulture population declines are linked to a likely infectious cause, with post-mortem studies revealing visceral gout, enteritis, vasculitis, and potential influence of rabies.

4 Roadside Risks

Vultures, particularly White-rumped Vulture, often breed near roads, where human activity and traffic pose risks, as they may feed on carcasses and become vulnerable to accidents.

5 Electro Fatal Lines

Vultures often perch on power lines leading to fatal electric shocks, causing a decline in their population.

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6 Concrete Collisions

Collisions with skyscrapers are a significant factor in the population decline of vultures as individuals frequently collide with these structures during foraging or migration activities.

7 Climate Change

Climate change, driven by increased greenhouse gas emissions threatens temperature and precipitation patterns, potentially shifting vulture habitats due to changes in carbon concentrations from anthropogenic activities.

8 Food Scarcity

Lack of availability of carrion is the major threat and this shortage can have significant ecological, environmental, and biological implications.

9 Body Parts in Use

Vulture parts, used in various forms such as powders, mixtures, or smears, are consumed or applied in traditional practices for protection, healing, and spiritual purposes, including warding off witches.

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Flora of the Rocky Outcrops

Nature's Resilient Gems

Rock outcrops are visible exposures of bedrock or other geologic formations at the surface of the Earth

Plants in rocky outcrops often endure high temperatures, intense sunlight, limited water availability, and nutrient-poor soils.

Vegetation on rocky outcrops plays a role in stabilizing local climates by reducing soil erosion and moderating temperatures

Many plants on rocky outcrops are endemic, meaning they are found only in these specific environments. The isolation of rocky outcrops often leads to the evolution of unique species.

Threats

Habitat Destruction

Urbanization and Infrastructure Development

Agricultural Expansion

Overexploitation of Resources

Rock and Mineral Extraction

Climate Change

Temperature and Rainfall Variability

Invasive Species

Competition with Native Plants

Pollution

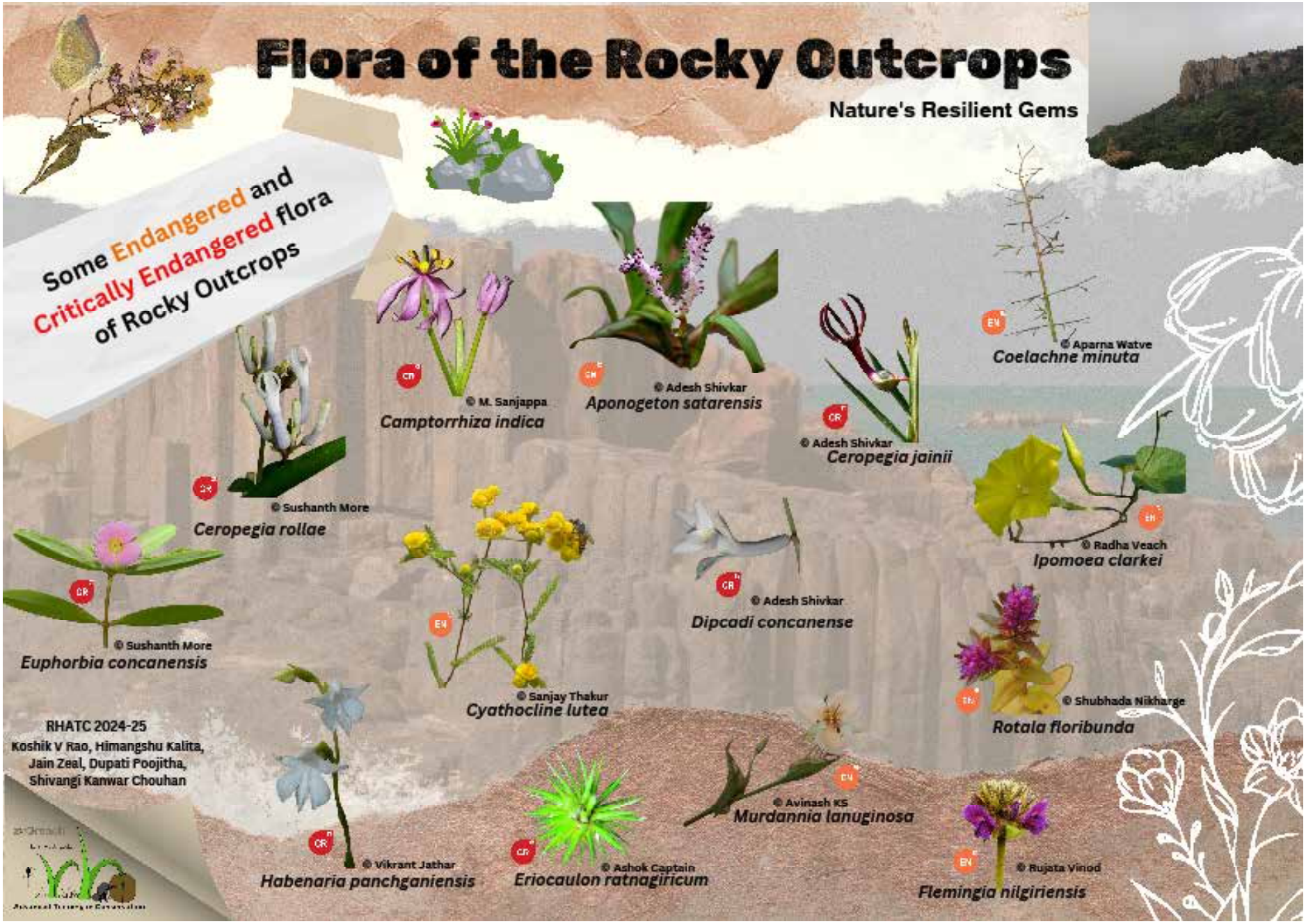
Air Pollution

Water Pollution

Soil Pollution

Rocky outcrops aren't barren wastelands—they're vibrant ecosystems teeming with unique species that have mastered the art of survival. it's our privilege and duty to protect these natural wonders!

RHATC 2024-25
Koshik V Rao, Himangshu Kalita, Jain Zeal, Dupati Poojitha, Shivangi Kanwar Chouhan



FAUNA OF ROCKY OUTCROPS

What are they?

Rocky outcrops are large exposed rocks that stand above the surrounding surface.

They can be found in many different shapes and sizes.

These include granite boulders, cliffs, dome shaped inselbergs and plateaus.

CREATED BY: ANANDITHA PASCAL, DIYA BANERJEE, GUPTA PRIYA, MOHSIN AHMAD, SIDHARTHAN
RHATC FELLOWS 2024-25

Watch out for these animals!

Aaron Bauer's House *Gecko*

Indian Golden Gecko

Humbali Village Toad

Crested Lark

Amboli Toad

RHATC ASSIGNMENTS


zoOreach
Advanced Training in Conservation
Shore birds
RHATC 2024-25
Dupati Poojitha, Koshik V Rao, Jain Zeal, Anandhitha Pascal and Sidharthan
Shore birds inhabit coastal and wetland habitats
Primarily feed on small crustaceans, mollusks, insects, and other invertebrates
Show ground-nesting behaviour
Play an essential role in the ecosystem by controlling invertebrate populations and serving as indicators of climate change
Most of these birds are from two taxonomic families, Scolopacidae (sandpipers) and Charadriidae (plovers)
© Ian Davies
© Aseem Kothiala
© Marco Valentini
© Hiren Khambhayta
THREATS
Sand mining
Pollution
Invasive Species
Predators
Climate Change
© Jonathan Eckerson
© Rajkumar Das

SOME OF THE SHOREBIRDS

Ruddy Turnstone
(*Arenaria interpres*)

© Arpit Bansal

Tibetan Sand Plover
(*Anarhynchus atrifrons*)

© Rajkumar Das

© Vivek Saggark

Eurasian Curlew
(*Numenius arquata*)

Common Sandpiper
(*Actitis hypoleucos*)

© Parmil Kumara

Little Stint
(*Calidris minuta*)

© Sourav Mandal

Little Ringed Plover
(*Thinornis dubius*)

© Arpit Bansal

Shorebird habitats of the Indian subcontinent may be roughly divided into wetlands, forest & shrub, grasslands, deserts & semi-desert, rivers & streams, and coasts & islands.

East coast has more diversity & West coast has higher abundance of shorebirds

Conservation Strategies:

- Habitat protection and restoration.
- Implementing bycatch reduction techniques in fisheries.
- Restricting human activities in sensitive areas.
- Removing invasive species and enhancing biosecurity.
- Increasing public awareness and enforcing legal protections.
- Conducting further research on cumulative anthropogenic impacts.

MAJOR THREATS

1.Habitat Loss and Degradation

Coastal development such as sea wall construction, urbanization, and shrinkage of mudflats due to sand deposit, mangrove expansion and agricultural expansion.

2.Human Disturbance

Recreational activities, boats, drones, and off-road vehicles disrupt feeding, roosting, and breeding activities.

3.Fisheries

Bycatch and entanglement in fishing gear lead to injury and mortality.

4.Predators

Mammalian predators such as dogs, cats, and rats prey on eggs, chicks, and adult birds, affecting breeding success.

5. Extreme Weather

Events like storms and flooding destroy habitats and cause direct harm to birds, eggs, and chicks.

RHATC 2024-25

Koshik V Rao, Jain Zeal, Anandítha Pascal, Dupati Poojitha and Sidharthan

Advanced Training in Conservation

Biodiversity Mapping: Monitoring Changes Through Land Use Changes

Biodiversity mapping was initiated as part of an educational workshop led by Payal Molur, designed to heighten awareness of the often-overlooked biodiversity in our daily surroundings. As RHATC fellows, along with workshop participants, we undertook the task of creating a detailed biodiversity map within a 100-meter radius around the Zooreach Field Station in Saravanampatti.

Using footsteps to measure distances, we translated our observations into a scaled visual representation on paper, documenting the existing vegetation diversity. This base map was then digitized and enhanced using Canva, where species recorded from field surveys were systematically added. The exercise commenced on October 24, 2024, and continued monthly until January 11, 2025. During this period, we consistently identified and mapped the area's faunal diversity, while monitoring changes in biodiversity.

Over the months, noticeable land use and land cover changes were observed, significantly impacting the biodiversity composition. Initially, the base biomap reflected abundant green cover, hosting diverse species of insects, birds, reptiles, and other invertebrates. However, as land clearing for construction and other activities progressed, the area's biodiversity began to decline in that area.

This exercise not only brought immense joy as we deepened our connection with the environment but also provided valuable insights into the dynamic relationship between habitat alteration and biodiversity. It highlighted the importance of documenting and preserving our surroundings amidst rapid urbanization.

Between October and February, the biodiversity around the Zooreach Field Station experienced significant changes due to land clearing for construction activities. Initially, the area was characterized by abundant green cover that supported a diverse array of insects, birds, reptiles, and invertebrates. However, as urbanization progressed, this green cover diminished substantially, resulting in a marked decline in species diversity. The faunal composition became less varied, with many species either displaced or lost altogether.

These changes underscored the adverse impacts of land use alterations on local ecosystems, highlighting the critical need to incorporate conservation strategies into urban planning.

Conversely, the establishment of a nursery with native plants in the area led to an increase in insect and invertebrate diversity. This suggests that planting native flora provides better support for local biodiversity, enabling more

species to thrive compared to areas dominated by non-native or invasive vegetation.

Biodiversity mapping can serve as a transformative educational tool for schools and eco-clubs in both rural and urban areas. By engaging students in hands-on mapping activities, it fosters environmental awareness, scientific rigour, and active participation in conservation efforts. For example, a rural school could map the biodiversity around nearby farmlands, identifying critical areas where pollinators thrive. If plans arise to clear a portion for expansion, students could use their data to advocate for the preservation of pollinator habitats, showing the importance of these species to local agriculture.

In urban schools, children could map green spaces on their campus and monitor changes over a year. If a plantation drive is proposed, their data could guide the selection of native species that are better suited to the environment, demonstrating the ecological benefits of such choices.
Eco-clubs could use mapping to track changes in bird populations or insect diversity in local parks. If a park area is scheduled for redevelopment, students can present their findings to local authorities, proposing strategies to integrate biodiversity-friendly designs like butterfly gardens or birdhouses.

These activities not only inspire stewardship but also embed scientific rigor, teaching students data collection, analysis, and effective advocacy—all vital skills for driving meaningful environmental change.

Koshik V Rao, Sidharthan, Diya Banerjee, Shivangi Kanwar Chouhan, Dupati Poojitha, Gupta Priya, Himangshu Kalita, Jain Zeal, Ananditha Pascal & Mohsin Ahmad, RHATC Fellows 2024–25, Zoo Outreach Organisation, Coimbatore, Tamil Nadu, India.

Biomap Keys

Date: 24 October 2024

Snail
Bee/ Wasp
Ant
Spiders
Moth
Butterfly
Hopper
mosquito

Beetle
Dragonfly
Damselfly
Grasshopper

Small Bird
Medium Bird
Big Bird

Gecko
Skink
Snake
Lizard

Frogs

Hare
Mongoose
Squirrel
Rat
Bat
Bug
Eggs
Caterpillar
Millipede

Biomap Keys

Date: 25 October 2024

Snail
Bee/ Wasp
Ant
Spiders
Moth
Butterfly
Hopper
mosquito

Beetle
Dragonfly
Damselfly
Grasshopper

Small Bird
Medium Bird
Big Bird

Gecko
Skink
Snake
Lizard

Frogs

Hare
Mongoose
Squirrel
Rat
Bat
Bug
Eggs
Caterpillar
Millipede

Biomap Keys

Date: 26 October 2024

Snail
Bee/ Wasp
Ant
Spiders
Moth
Butterfly
Hopper
mosquito

Beetle
Dragonfly
Damselfly
Grasshopper

Small Bird
Medium Bird
Big Bird

Gecko
Skink
Snake
Lizard

Frogs

Hare
Mongoose
Squirrel
Rat
Bat
Bug
Eggs
Caterpillar
Millipede

Biomap Keys

Date: 30 October 2024

Snail
Bee/ Wasp
Ant
Spiders
Moth
Butterfly
Hopper
mosquito

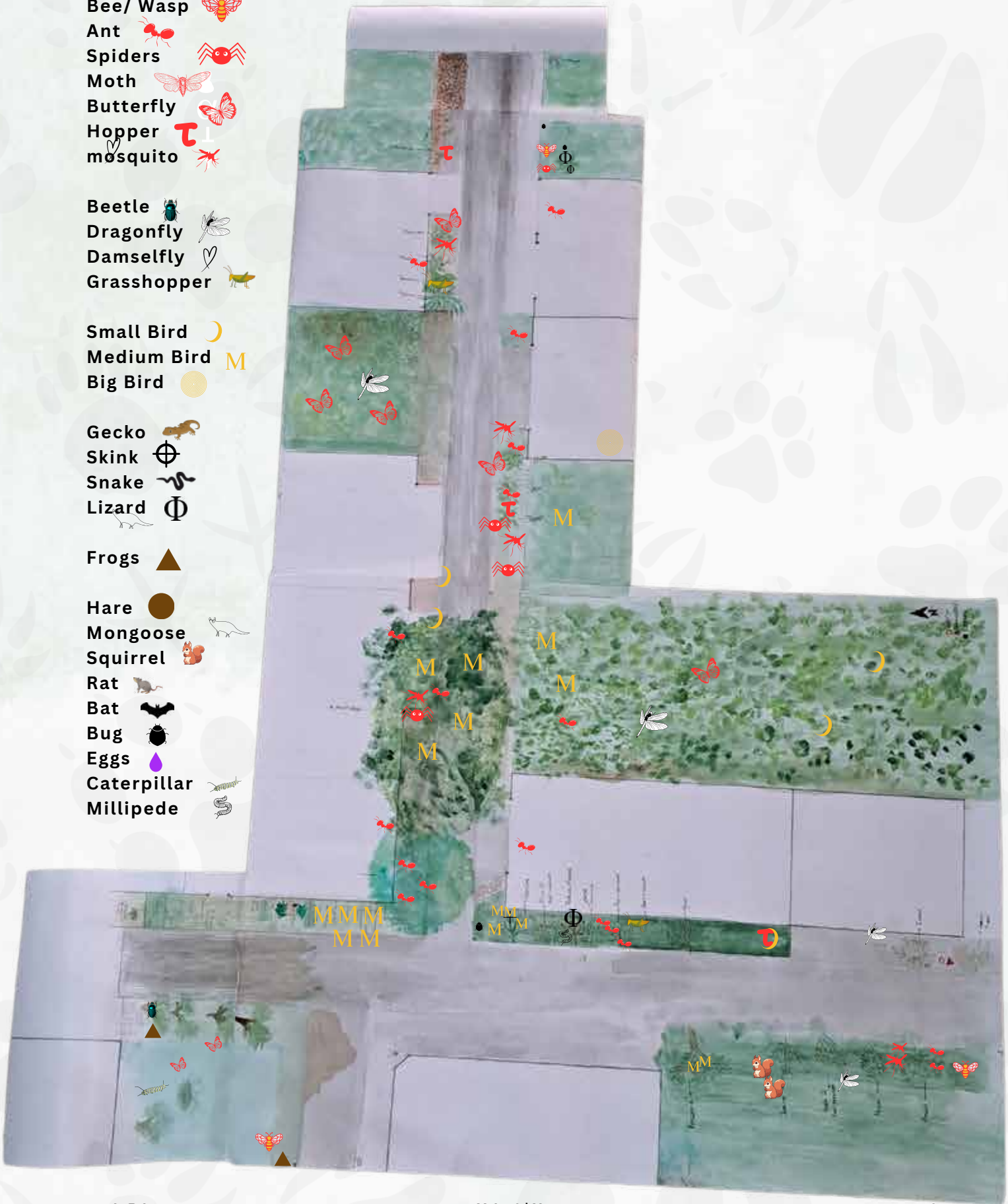
Beetle
Dragonfly
Damselfly
Grasshopper

Small Bird
Medium Bird
Big Bird

Gecko
Skink
Snake
Lizard

Frogs

Hare
Mongoose
Squirrel
Rat
Bat
Bug
Eggs
Caterpillar
Millipede



Biomap Keys

Date: 12 November 2024

Snail
Bee/ Wasp
Ant
Spiders
Moth
Butterfly
Hopper
mosquito

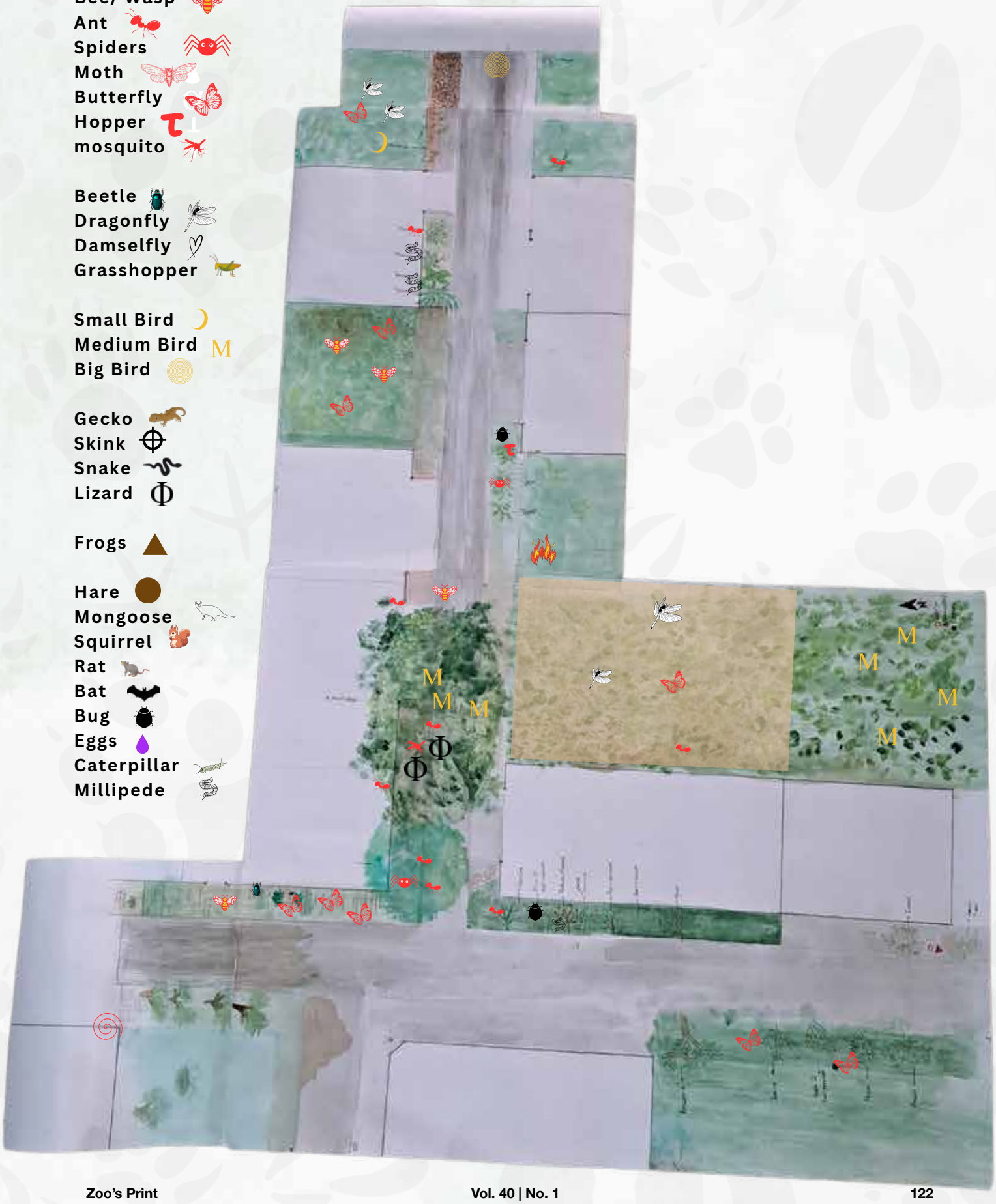
Beetle
Dragonfly
Damselfly
Grasshopper

Small Bird
Medium Bird
Big Bird

Gecko
Skink
Snake
Lizard

Frogs

Hare
Mongoose
Squirrel
Rat
Bat
Bug
Eggs
Caterpillar
Millipede



Biomap Keys

Date: 25 November 2024

Snail
Bee/ Wasp
Ant
Spiders
Moth
Butterfly
Hopper
mosquito

Beetle
Dragonfly
Damselfly
Grasshopper

Small Bird
Medium Bird
Big Bird

Gecko
Skink
Snake
Lizard

Frogs

Hare
Mongoose
Squirrel
Rat
Bat
Bug
Eggs
Caterpillar
Millipede

Biomap Keys

Date: 19 December 2024

Snail
Bee/ Wasp
Ant
Spiders
Moth
Butterfly
Hopper
mosquito

Beetle
Dragonfly
Damselfly
Grasshopper

Small Bird
Medium Bird
Big Bird

Gecko
Skink
Snake
Lizard

Frogs

Hare
Mongoose
Squirrel
Rat
Bat
Bug
Eggs
Caterpillar
Millipede

Biomap Keys

Date: 04 January 2025

Snail
Bee/ Wasp
Ant
Spiders
Moth
Butterfly
Hopper
mosquito

Beetle
Dragonfly
Damselfly
Grasshopper

Small Bird
Medium Bird
Big Bird

Gecko
Skink
Snake
Lizard

Frogs

Hare
Mongoose
Squirrel
Rat
Bat
Bug
Eggs
Caterpillar
Millipede

Biomap Keys

Date: 11 January 2025

Snail
Bee/ Wasp
Ant
Spiders
Moth
Butterfly
Hopper
mosquito

Beetle
Dragonfly
Damselfly
Grasshopper

Small Bird
Medium Bird
Big Bird

Gecko
Skink
Snake
Lizard

Frogs

Hare
Mongoose
Squirrel
Rat
Bat
Bug
Eggs
Caterpillar
Millipede

Imaginary Animal Creation Activity

During an educational workshop led by Payal Molur, we participated in a creative and engaging activity: designing our own imaginary animals. This exercise encouraged us to visualize and illustrate fictional creatures, allowing us to bring to life unique traits and characteristics from our imagination. It was an exciting opportunity to explore creativity and give form to our envisioned creations.

Each fellow is tasked with creating a fictional animal using their creativity. They must provide detailed information about their creation, including:

- The animal's name.
- Its habitat (where it lives).
- Its diet (what it eats).
- Its predators (who preys on it).
- Its defence and attack mechanisms (how it protects itself and how it attacks).

The description should comprehensively explain the characteristics and behaviours of the created animal.

Species: *Spinachirus viridisus* (Spiny Greenhunter Lizard)

Creator: Koshik V Rao*

The *Spinachirus viridisus*, commonly known as the Spiny Greenhunter Lizard, is a fascinating imaginary creature that thrives in grassy, green landscapes where it can easily blend into its surroundings, providing effective camouflage. Its vibrant green colouration helps it remain nearly invisible to predators in its natural habitat. This lizard has a unique and diverse diet, feeding on nectar, termites, ants, and various other insects. To attract its prey, the Spiny Greenhunter Lizard secretes a sweet syrup from a sugary sac located at the tip of its tail. This sugary substance attracts insects and other small creatures, luring them closer to the lizard's reach. Additionally, the lizard employs its long, sticky tongue to capture prey, allowing it to strike with precision. Despite its hunting skills, the *Spinachirus viridisus* faces constant threats from predators such as birds and wild cats. To protect itself, it has evolved spiny hairs along its upper abdomen. These sharp, stiff spines deter potential predators by causing discomfort and acting as a physical barrier against attacks. This lizard was created imagining a monitor lizard, anteater and porcupine.

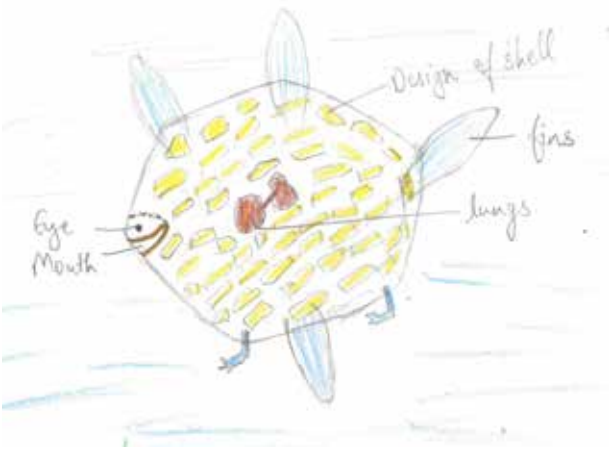
Species: *Capra lightning* (Hengal Kastoor)

Creator: Mohsin Ahmad*

The imagined species, locally known as Hengal Kastoor and scientifically named *Capra lightning*, is a high-altitude ungulate uniquely adapted to life in rugged, forested terrains. This creature inhabits steep edges, relying on its distinct physical features for survival. It has a rusty-brown body, a long tail, and striking red eyes that may enhance vision under low-light conditions. The animal primarily feeds on grasses and shrubs, making it an herbivore well-suited to the vegetation available in its habitat. For defence, it possesses large, robust horns, which likely serve to deter predators or engage in intraspecific competition. A remarkable adaptation is its wings, enabling it to navigate steep cliffs and escape threats with ease. Despite these traits, it is a prey species for high-altitude predators, contributing significantly to the ecological dynamics of its environment.

Species: *Piscefin shell* (Hexagonal leg swimmer)

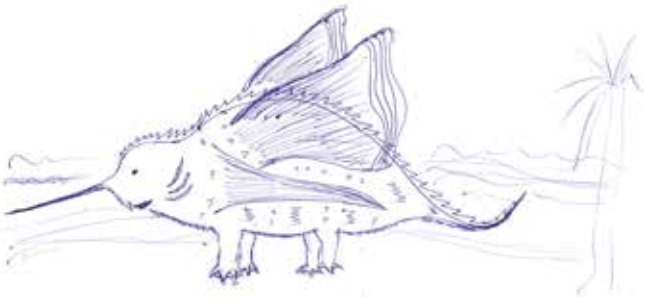
Creator: Shivangi Kanwar Chouhan*



The Hexagonal Leg Swimmer is an extraordinary imaginary aquatic creature that thrives in freshwater and coastal areas. This unique species is equipped with a single eye and mouth, along with lungs that allow it to breathe while basking in the sun. It is protected by a hard, hexagonal shell that not only acts as armour but also emits light as a defence mechanism to deter predators. The Hexagonal Leg Swimmer is an agile swimmer, thanks to its four powerful fins that enable it to glide swiftly through the water when pursued by predators. Additionally, it possesses two small legs that allow it to run across the water's surface—a remarkable adaptation for evading threats. This species primarily feeds on small fish and sea grasses, while its natural predators include larger fish, whales, and sharks. Interestingly, the Hexagonal Leg Swimmer harnesses energy from the sun during its basking periods and uses this energy to power its swimming, making it both efficient and fascinating in its behaviour.

Species: *Avohydrosaurus squamaii* (Long-Snouted Scaly Avohydrosaur)

Creator: Himangshu Kalita*



This imaginary species is a fascinating blend of adaptations, allowing it to thrive in multiple environments. Predominantly terrestrial, the Long-Snouted Scaly Avohydrosaur can also fly with its featherless wings and swim underwater, thanks to its gill slits and webbed feet. It possesses a narwhal-like pointed snout made of hardened shell material, which it uses to hunt prey. Its body is covered with thorny scales, providing excellent defence against potential attackers, while its pointed, highly mobile tail and two-side fins enhance its agility in the water. The Avohydrosaur is a large-bodied creature, roughly the size of an elephant. It is usually solitary, coming together in pairs only during the mating season. A viviparous species, it gives birth to up to two offspring after an 18-month gestation period. This omnivorous apex predator feeds on a wide range of marine species, terrestrial animals, birds, and even plants. It attacks almost anything for food and has no known natural predators. However, its legs are considered its weak point, potentially making it vulnerable to determined carnivores. The Long-Snouted Scaly Avohydrosaur is thought to inhabit the unexplored islands of the Galapagos, where its unique adaptations allow it to dominate the ecosystem.

Species: *Serpentine macaca*

Creator: Gupta Priya*

Serpentine macaca is an animal found in the forests near water bodies on Sentinel Island. It feeds on blood, flesh, and occasionally plants. This creature grows up to 7 meters, and has a monkey-like head and a snake-like body from neck to tail covered with thick and smooth scales. It uses its two hands to climb trees for food and sleep. With plus-shaped lenses, its vision is distorted and weak, but it compensates with a strong sense of hear thanks to its big ears. Equipped with two large canines, helps it to hold on prey, although its own predators are yet to be discovered.

Species: *Goatris spikensis* (Spikey goat)

Creator: Jain Zeal*

It is a grassland species with great peripheral vision because of its ability to move its round pupil 360 degrees. It develops a striped body and low height as an adaptation to save itself from the vision of the predator in the grass and run fast. Due to the low height, it's most possible for it to be attacked on its neck, hence the spikes. It is a herbivore and feeds on tussock grasses and perennial herbs is predated by top predators such as hyenas, wild dogs and snakes.

Species: *Aethera iridans* (Iridescent Glider)

Creator: Ananditha Pascal*

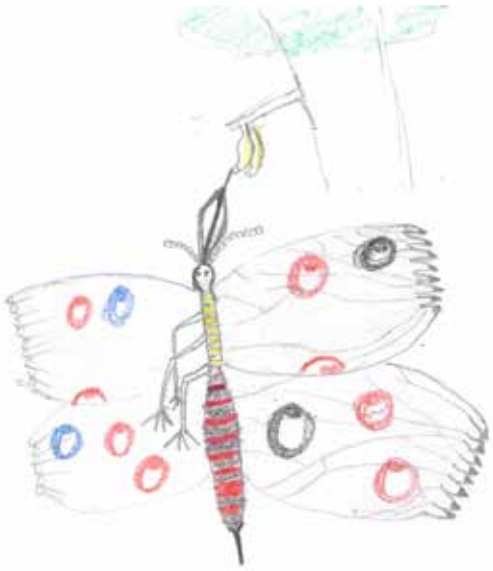
The Iridescent Glider is a species inhabiting the evergreen and moist deciduous forests of South India. As a herbivore, it primarily feeds on the fruits of seasonal plants, ensuring a steady food supply throughout the year. The species possesses exceptional vision and the ability to sense vibrations, aiding in survival and navigation. Its iridescent plumage serves as effective camouflage. Additionally, its flesh has an unpleasant taste, deterring many potential predators. An adept flier, the Iridescent Glider has a streamlined body and a distinctive triangular tuft on its head, which minimizes air resistance and makes flight efficient. This combination of physical adaptations and behavioural traits would make the Iridescent Glider a successful animal of the wild.

This activity was both fun and enriching, allowing us to unleash our artistic and creative sides with childlike enthusiasm. It provided a unique platform to merge creativity with ecological thinking, making it an unforgettable and enjoyable experience for everyone involved.

Species: *Mobile eyespotfruista*

Creator: Diya Banerjee*

The species *Mobile eyespotfruista*, described by Diya Banerjee in 2024, is an imaginary butterfly evolved for survival. Urbanization led to plant loss, prompting it to develop long legs for fishing by riverbanks. Feeding on both fruit and fish, it possesses teeth and a proboscis for nectar. To combat predators like lizards and birds, it evolved a stinging abdomen with black-and-red stripes to deter threats. Its wings are adorned with vibrant blue, red, and black eyespots, confusing and beguiling predators. Living in forests, this butterfly showcases remarkable adaptations, embodying the concept of survival through innovation and resilience in a changing world.



Species: *Animalia autotropha*

Creator: Sidharthan*

Animalia autotropha is a marvel of evolution, a mammal that defies all conventional boundaries. With powerful wings enabling graceful flight and agile legs for unparalleled speed on land, it is untouchable by predators. A carnivore by instinct, it can devour anything it encounters, showcasing unmatched adaptability in diverse ecosystems. Yet, its most extraordinary trait is its ability to photosynthesize, thanks to chlorophyll-rich cells embedded in its fur. Thriving equally on land and in water, *Animalia autotropha* is the ultimate survivor, harnessing sunlight for energy while hunting with precision. This luminous being is a symbol of resilience and ecological ingenuity. Similar to the golden age of reptiles, now we will have a golden age of autotrophs in the Anthropocene era once they flourish and establish their dominance.

Species: *Slythene aqua*

Creator: Dupati Poojitha*

Slythene aqua is an imaginary creature inhabiting islands and thrives on a diet of fish and aquatic and terrestrial plants, making it an omnivore. As the top predato in its ecosystem, it sits at the apex of the food chain. However, its plant-based diet ensures an optimal energy intake with minimal energy loss through the food chain. *Slythene aqua* has a long, slender body covered in shimmering scales. It has four clawed appendages and unique elongations on its forehead - modified scales used to attract mates. Adding to its striking appearance, feathers on the anterior dorsal side of its body enable it to fly. These feathers are supported by specialized oil glands that keep them waterproof, ensuring the creature can seamlessly transition between water and air. By day, *Slythene aqua* rests in burrows near the seashore and becomes active at night as a skilled nocturnal hunter. Under moonlight, its scales reflect light, causing the creature *Slythene aqua* was drawn from the Os to glisten—a feature that not only dazzles but also plays a crucial role in mate selection. The inspiration for car-winning film *Spirited Away*, which sparked the idea for its design and characteristics.

*RHATC Fellow 2024–25, Zoo Outreach Organisation, Coimbatore, TN, India.

CAMPAIGN ACTION PLAN

Anandítha Pascal & Mohsin Ahmad

The following campaign action plan was developed as part of a group exercise assigned during our sessions with campaign strategist Cara Tejpal. Rapid urbanization and increasing preference for exotic, non-native plant species in landscaping have out-numbered the native plants. Native species play a critical role in maintaining native biodiversity and improve ecosystem health. Therefore, we chose to work on an awareness and action campaign titled "Native Greens of Coimbatore Plains" to restore and promote the restoration and conservation of native plant species. Through collaboration with students, academic institutions, urban planners, and the city's Municipal Corporation, the campaign will emphasize the ecological significance of native vegetation and drive action towards the same.

Title of the campaign:

"NATIVE GREENS OF COIMBATORE PLAINS"

Namma Chedi, Namma Perimai!

நம்ம செடி நம்ம பெருமை

Objective:

- Generate awareness and promote restoration of native plants of Coimbatore plains by engaging students, schools and universities.
- Collaborate with Coimbatore City Municipal Corporation and Urban Forestry Department to promote the restoration of native species across the city.

Type of campaign:

- Awareness
- Pride
- Action

Target:

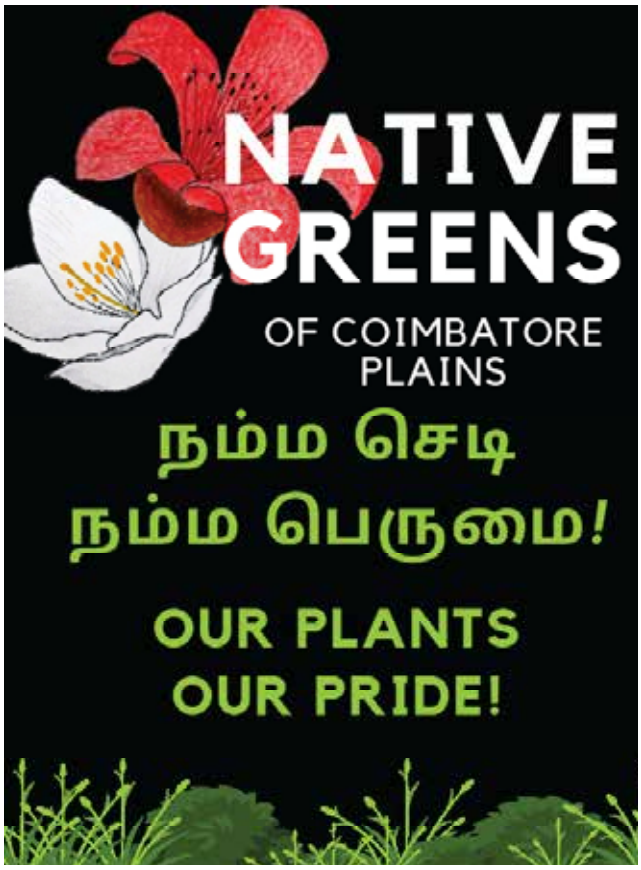
- Establish and maintain a native plant nursery.
- Reach out and collaborate with academic institutions to generate awareness among students and promote restoration via workshops and nature club activities.

Collaborators:

- NGOs – Zoo Outreach Organisation
- Ecologists
- Botanists
- Nature educators
- Teachers and academic nature clubs
- Student volunteers
- Coimbatore City Municipal Corporation
- Urban Forestry Department

Audience

- General public
- Teachers
- High school students (government and private schools)
- University graduation students



- Coimbatore City Municipal Corporation
- Urban Forestry Department

Timeline

5 years

Tools and Resources

- Educational workshops
- Volunteer programs
- Visual materials (posters, information cards, and a checklist of native plant species)
- Pocket notebooks for plant identification and recording
- A detailed 'Guide' to the native flora of Coimbatore plains
- Social media page

Campaign Action Plan

1. Secure Funding

- Draft a comprehensive proposal and approach Corporate Social Responsibility (CSR) initiatives of companies operating in Coimbatore.
- Highlight the campaign's ecological and educational impact to attract sponsors.
- Seek partnerships with NGOs like Zoo Outreach Organisation and academic institutions for additional resources and support.

2. Research and Information Collation

- Assemble a panel of ecologists and botanists to consolidate knowledge about Coimbatore's native vegetation.
- Facilitate discussions and knowledge exchange to identify key native species, their ecological significance and unique traits.
- Create a checklist ('Checklist to the Native Flora of Coimbatore Plains') featuring major native plants species of the city.

3. Educational Outreach

Workshops for Schools and Universities:

- Conduct interactive workshops in government and private schools to educate students about native plants and their importance. Distribute and use information cards for education activity.
- Collaborate with nature clubs in universities to expand outreach and foster student involvement.

Teacher and Volunteer Training:

- Train teachers and student volunteers as campaign ambassadors to aid in additional activities and to build networks for the campaign.

4. Flora Checklist and Recording Initiative

- Collaborate with student nature clubs to create an inventory of Coimbatore's native plants.
- Distribute pocket-sized notebooks as "**Native Flora Journal: Coimbatore Plains Edition**" to students to identify and record native plants they spot in their localities or during visits.
- Award stamps for each identified entry, and provide a certificate of completion upon filling the notebook.
- Leverage the insights from this initiative to enhance the checklist into a comprehensive guide on Coimbatore's native flora, with contributions from students in terms of content, illustrations, and design. This will also be done with the guidance of our panel of botanists, ecologists and nature educators.
- Publish the book and recognize all contributors for their efforts.

5. Establish a Native Plant Nursery

- Engage student volunteers to source seeds and saplings of native plants for the nursery.
- Develop the nursery as a community resource to support restoration drives and native plant propagation.

6. Restoration Drives

- Organize restoration in schools, university campuses and gated residential communities through collaborating nature clubs and campaign student ambassadors.

- Encourage students to take ownership by nurturing planted saplings in their institutions or communities.

8. Social Media Strategy

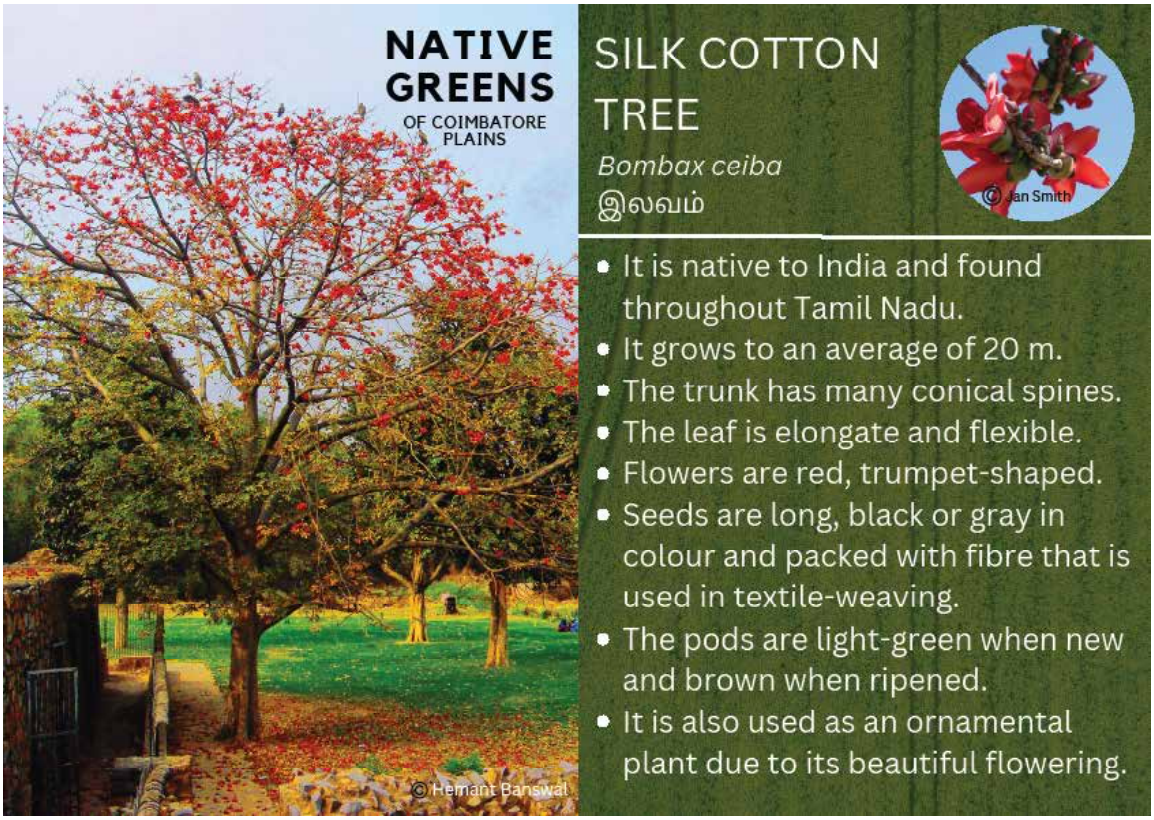
- Campaign Visibility: Create and maintain an active social media page to promote the campaign, educate the public, and expand its reach.
- Event Notifications: Announce upcoming workshops, restoration drives, and collaborative programs.
- Progress Updates: Share milestones achieved, such as species documented, schools and colleges onboarded, species to be included in the native nursery etc.
- Volunteer Recognition: Highlight student volunteers, contributors to the guidebook, and participants who complete the pocket notebook with posts and certificates.
- Educational Content: Post native plant profiles, ecological facts, and snippets from the 'Guide to Coimbatore Plains Native Flora' with engaging visuals.
- Community Engagement: Encourage followers to share their campaign experiences using a campaign hashtag (e.g., #NativeGreensofCovaiPlains).
- Visual Storytelling: Use photos, videos, and infographics to document restoration drives, campaign events, and the growth of native saplings.

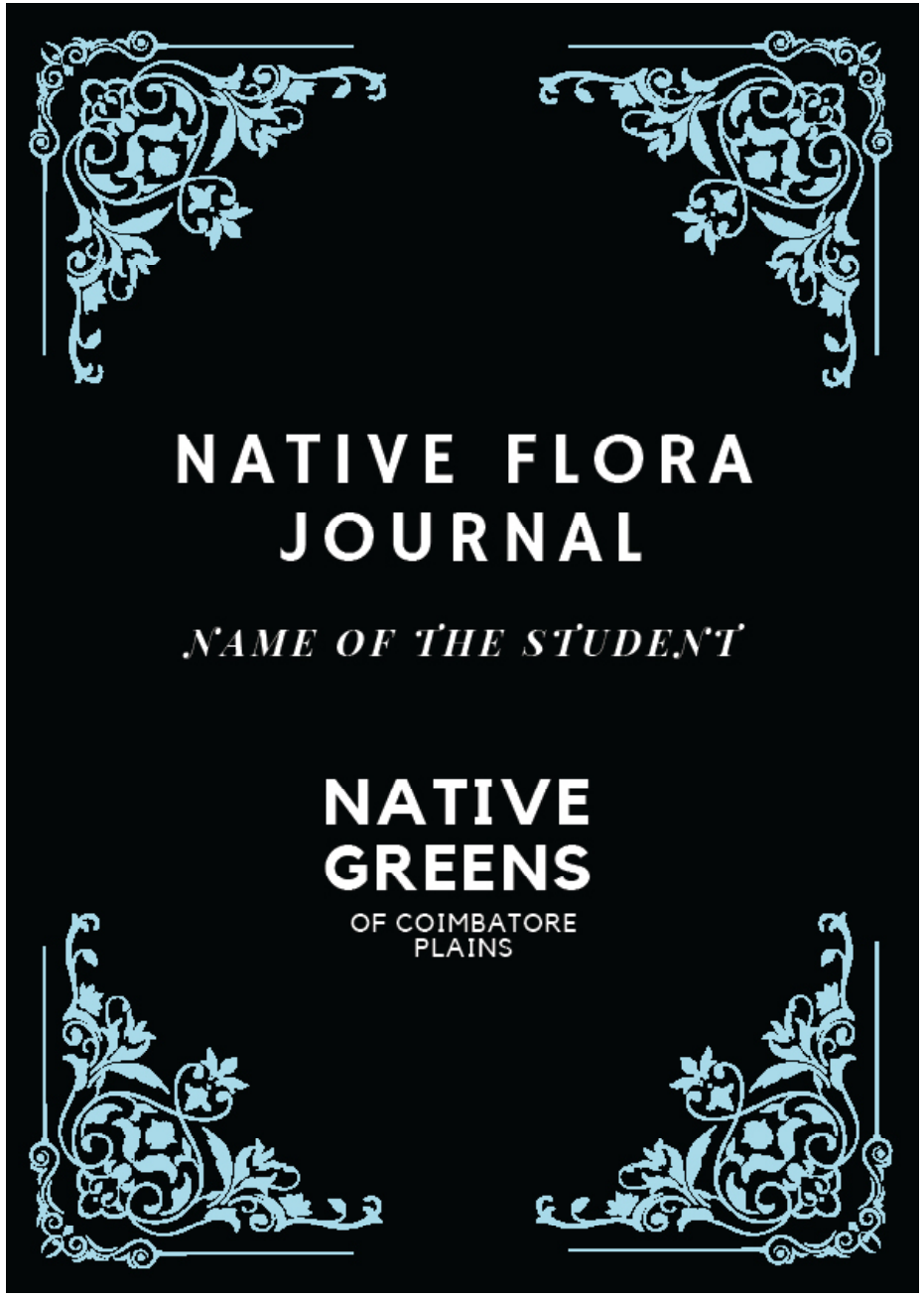
7. Government body Collaboration and Advocacy

- Present the campaign's achievements over three years to the Municipal Corporation and the Urban Forestry Dept, showcasing community engagement and environmental impact.
- Advocate for policies promoting native plants in urban planning and infrastructure projects.
- Offer saplings from the established native nursery as a resource for municipal landscaping efforts.

8. Future Plans

- Expand this campaign to other cities.
- Continue to work on the existing campaign.





NATIVE FLORA JOURNAL

DATE:

S M T W T F S

AREA/LOCALITY NAME: _____

WEATHER: _____

TIME: _____

NAME OF THE PLANT:

TYPE OF PLANT:
TREE/SHRUB/GRASS

FEATURES OF THE **PLANT:**

LEAF:
(COLOUR, SHAPE, SIZE)

FRUIT:
(COLOUR, SHAPE, SIZE, CLUSTER/SOLITARY)

FLOWER:
(COLOUR, SIZE, CLUSTER/SOLITARY)

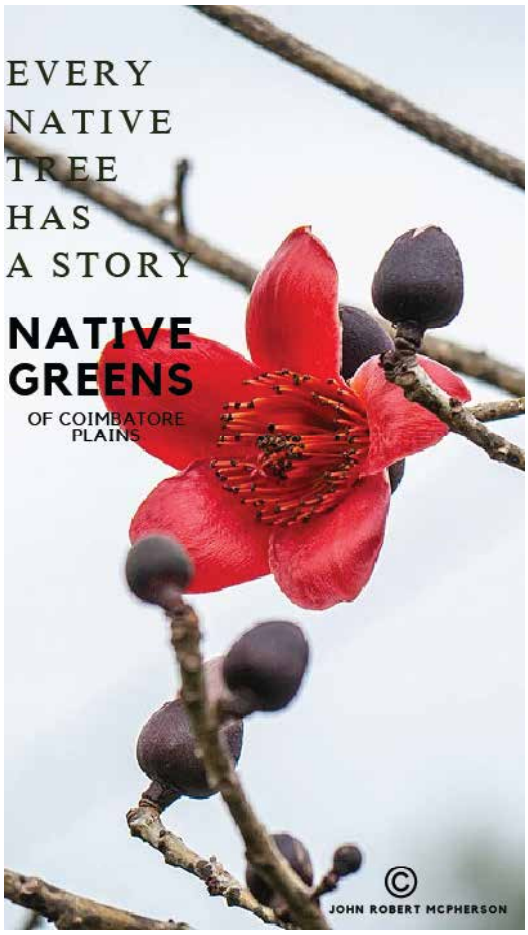
FEATURES OF THE LOCALITY:

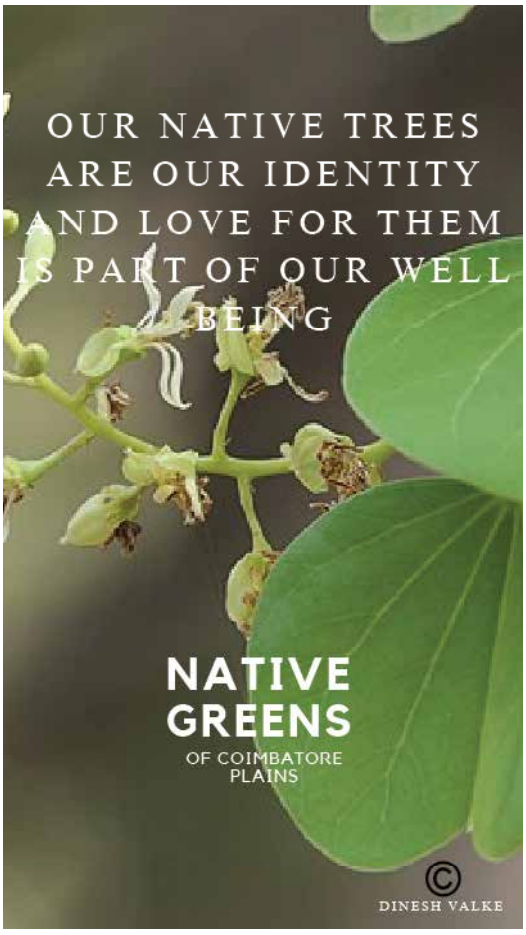
WAS THE PLANT STANDING ALONE OR IN A GROUP?
WAS THE LAND A - ROADSIDE/FARMLAND/CAMPUS ETC?
ANY OTHER PLANTS/ANIMALS AROUND?

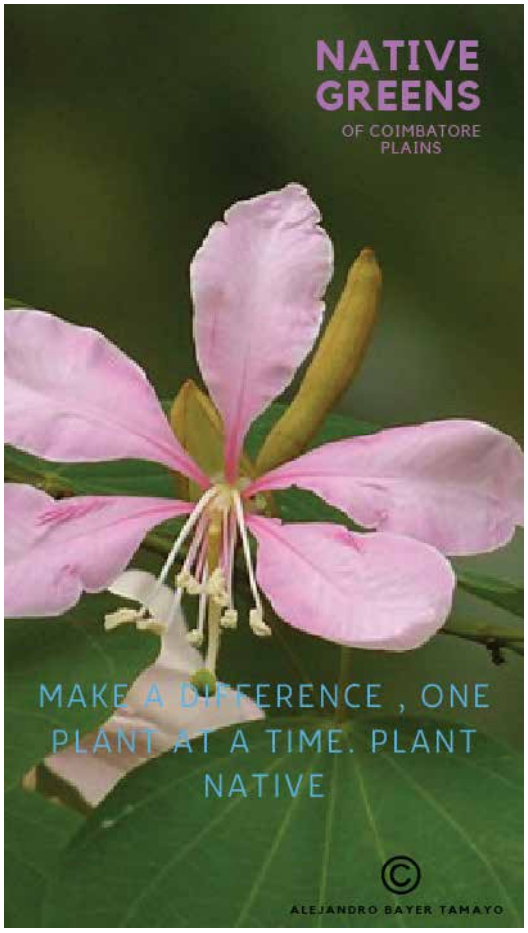
NOTES:

NATIVE GREENS
OF COIMBATORE PLAINS

RHATC CAMPAIGNS







BAUHINIA PURPUREA

JUNE 2025

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26	27	28	29	30		

NATIVE GREENS
OF COIMBATORE PLAINS

Damagundam Mana Vanam: A Campaign to Save Our Forests

Sidharthan and Dupati Poojitha

As part of the Ram Hattikudur Advanced Training in Conservation (RHATC), organized by the Zoo Outreach Organisation, a workshop on conservation campaigns was conducted for the fellows. The workshop aimed to equip participants with skills to design and execute effective conservation initiatives. During this session we were tasked with identifying a pressing conservation issue, develop a campaign strategy to address it, and present our plan. Fellows Dupati Poojitha and Sidharthan teamed up and started thinking about pressing issues in India. And finally, we decided to go with the Damagundam Reserve Forest in Telangana.

Context of the Campaign

The Damagundam RF is an ecological hotspot, rich in biodiversity and vital to local communities for its natural resources and cultural significance. However, this forest has been under threat due to developmental pressures, primarily due to the construction of a very low frequency (VLF) radar station by the Indian Navy.

The proposal for diverting 1,174 hectares of forest land for this project dates back to 2008. Over the years, various approvals and compliance stages were completed, culminating in a foundation stone laid in early 2024. Despite financial allocations for afforestation and compensatory measures, no substantial efforts to protect or restore the forest have been implemented.

The Situation That Inspired the Campaign

In October 2024, as the development plans gained momentum, concerns were raised about the irreversible damage that deforestation would cause.

- Environmental Impact: The loss of habitat for endemic species, soil erosion, and disruption of local hydrological cycles.
- Community Concerns: The livelihoods of local residents, who depend on the forest for resources and cultural identity, were at stake.
- Government Inaction: Despite approvals and funds allocated for afforestation, there was little progress in addressing the ecological damage or involving the local population in decision-making.

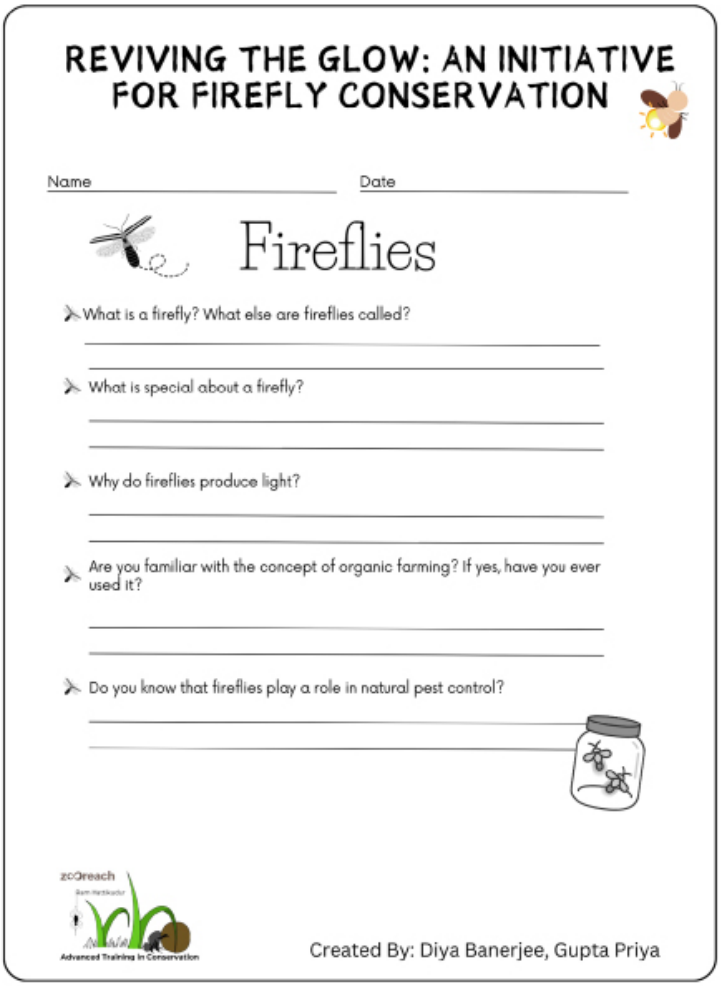
Faced with these challenges, the idea for the Damagundam Mana Vanam campaign emerged. Recognizing the urgent need for grassroots action, we designed the campaign to build awareness, foster community involvement, and advocate for the forest's protection.

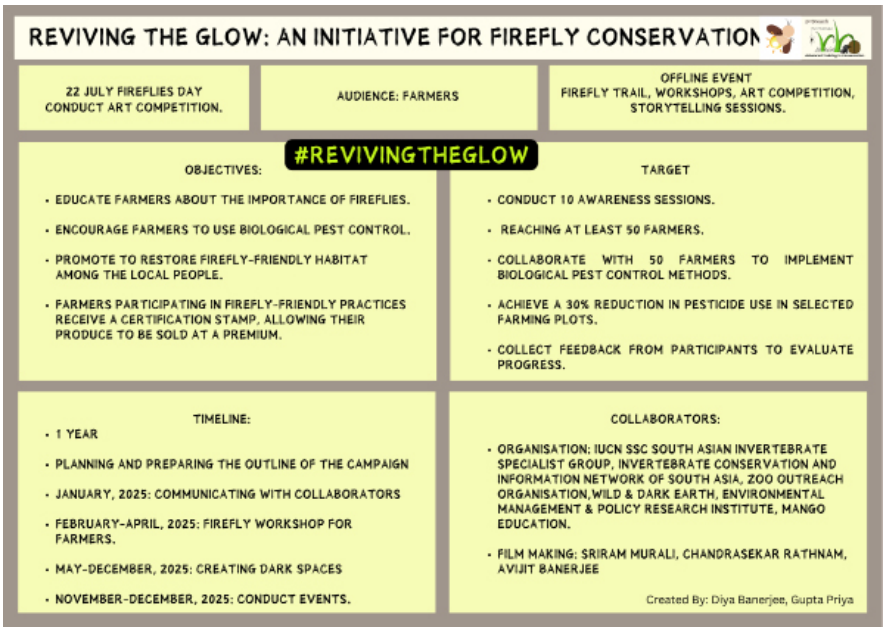
REVIVING THE GLOW

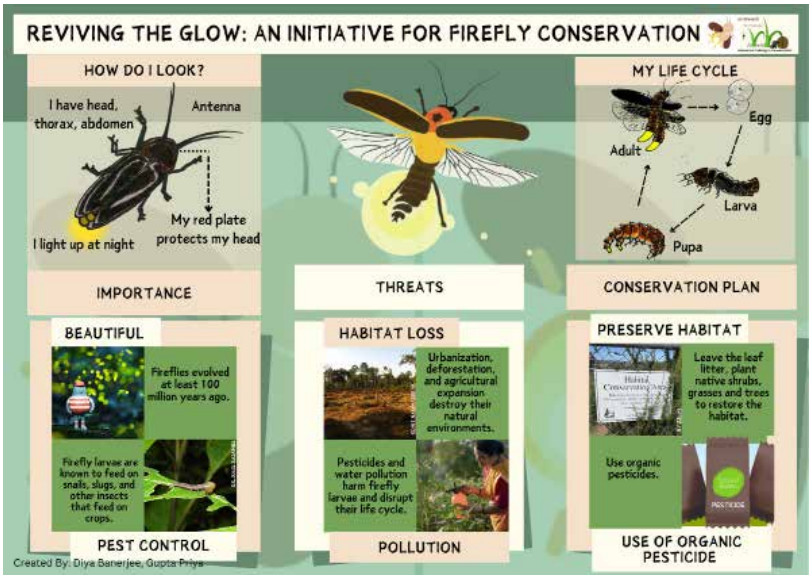
Diya Banerjee & Gupta Priya

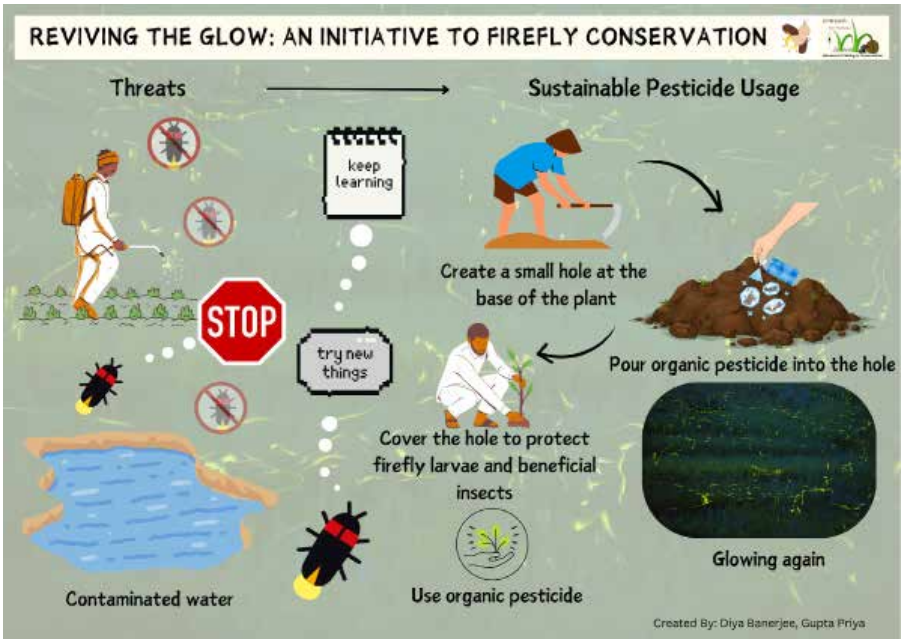
The following campaign action plan was developed as part of group exercise assigned during our sessions with campaign strategist Cara Tejpal.

Protecting fireflies is essential for maintaining a healthy ecosystem, as they are natural invertebrate predators and pollinators. Their mesmerizing glow inspires cultural and ecological awareness, but their decline due to light pollution and pesticide use signals broader environmental issues. Therefore, we chose to work on an awareness campaign titled "Reviving the glow: an initiative for firefly conservation" to raise awareness, promote firefly-friendly practices, and encourage sustainable farming methods. By protecting fireflies, we support biodiversity, improve agricultural outcomes, and preserve a natural wonder for future generations, fostering a deeper connection between communities and nature.




REVIVING THE GLOW: AN INITIATIVE FOR FIREFLY CONSERVATION
22 JULY FIREFLIES DAY
CONDUCT ART COMPETITION.
AUDIENCE: FARMERS
OFFLINE EVENT
FIREFLY TRAIL, WORKSHOPS, ART COMPETITION, STORYTELLING SESSIONS.
#REVIVINGTHEGLOW
OBJECTIVES:
• EDUCATE FARMERS ABOUT THE IMPORTANCE OF FIREFLIES.
• ENCOURAGE FARMERS TO USE BIOLOGICAL PEST CONTROL.
• PROMOTE TO RESTORE FIREFLY-FRIENDLY HABITAT AMONG THE LOCAL PEOPLE.
• FARMERS PARTICIPATING IN FIREFLY-FRIENDLY PRACTICES RECEIVE A CERTIFICATION STAMP, ALLOWING THEIR PRODUCE TO BE SOLD AT A PREMIUM.
TARGET
• CONDUCT 10 AWARENESS SESSIONS.
• REACHING AT LEAST 50 FARMERS.
• COLLABORATE WITH 50 FARMERS TO IMPLEMENT BIOLOGICAL PEST CONTROL METHODS.
• ACHIEVE A 30% REDUCTION IN PESTICIDE USE IN SELECTED FARMING PLOTS.
• COLLECT FEEDBACK FROM PARTICIPANTS TO EVALUATE PROGRESS.
TIMELINE:
• 1 YEAR
• PLANNING AND PREPARING THE OUTLINE OF THE CAMPAIGN
• JANUARY, 2025: COMMUNICATING WITH COLLABORATORS
• FEBRUARY-APRIL, 2025: FIREFLY WORKSHOP FOR FARMERS.
• MAY-DECEMBER, 2025: CREATING DARK SPACES
• NOVEMBER-DECEMBER, 2025: CONDUCT EVENTS.
COLLABORATORS:
• ORGANISATION: IUCN SSC SOUTH ASIAN INVERTEBRATE SPECIALIST GROUP, INVERTEBRATE CONSERVATION AND INFORMATION NETWORK OF SOUTH ASIA, ZOO OUTREACH ORGANISATION,WILD & DARK EARTH, ENVIRONMENTAL MANAGEMENT & POLICY RESEARCH INSTITUTE, MANGO EDUCATION.
• FILM MAKING: SRIRAM MURALI, CHANDRASEKAR RATHNAM, AVIJIT BANERJEE
Created By: Diya Banerjee, Gupta Priya


REVIVING THE GLOW: AN INITIATIVE FOR FIREFLY CONSERVATION
HOW DO I LOOK?
I have head, thorax, abdomen
Antenna
My red plate protects my head
I light up at night
MY LIFE CYCLE
Egg
Adult
Larva
Pupa
IMPORTANCE
BEAUTIFUL
Fireflies evolved at least 100 million years ago.
Firefly larvae are known to feed on snails, slugs, and other insects that feed on crops.
PEST CONTROL
THREATS
HABITAT LOSS
Urbanization, deforestation, and agricultural expansion destroy their natural environments.
Pesticides and water pollution harm firefly larvae and disrupt their life cycle.
POLLUTION
CONSERVATION PLAN
PRESERVE HABITAT
Leave the leaf litter, plant native shrubs, grasses and trees to restore the habitat.
Use organic pesticides.
USE OF ORGANIC PESTICIDE
Created By: Diya Banerjee, Gupta Priya


REVIVING THE GLOW: AN INITIATIVE TO FIREFLY CONSERVATION
Threats
Sustainable Pesticide Usage
keep learning
STOP
try new things
Contaminated water
Create a small hole at the base of the plant
Pour organic pesticide into the hole
Cover the hole to protect firefly larvae and beneficial insects
Use organic pesticide
Glowing again
Created By: Diya Banerjee, Gupta Priya

#100DaysForHollongapar

Himangshu Kalita and Koshik V. Rao

An Integrated Conservation Campaign for Safeguarding the Hollongapar Gibbon Wildlife Sanctuary in Assam, Northeastern India

> **"Destroying rainforest for economic gain is like burning a Renaissance painting to cook a meal."**
> **— E.O. Wilson**

What is it?

The #100DaysForHollongapar campaign is a focused initiative dedicated to the conservation of the biodiversity of Hollongapar Gibbon Wildlife Sanctuary in Assam, including the Western Hoolock Gibbon (Hoolock hoolock), India's only lesser ape species. This sanctuary is a critical habitat for the gibbons, but it faces significant challenges due to habitat fragmentation, deforestation, and human activities.

How the idea was conceived? – a little backstory

The #100DaysForHollongapar campaign emerged as part of an exercise inspired by a session conducted by Cara Tejpal, a renowned wildlife conservationist and campaign strategist as part of the Ram Hattikudur Advanced Training in Conservation (RHATC) course 2024-25 organized by Zoo Outreach Organisation, Coimbatore. This session focused on the power of campaigns as catalysts for wildlife conservation, emphasizing the importance of grassroots action, local engagement, and effective storytelling in addressing pressing ecological challenges.

Cara Tejpal, known for her advocacy work and her leadership in the Mud on Boots Project at the Sanctuary Nature Foundation, emphasized the importance of grassroots initiatives and the role of local communities in conservation efforts. Her session delved into the key elements of campaign design through interactive discussions and real-world examples. She guided participants in understanding how to design and implement campaigns that resonate with diverse audiences, inspire collective action, and create tangible change.

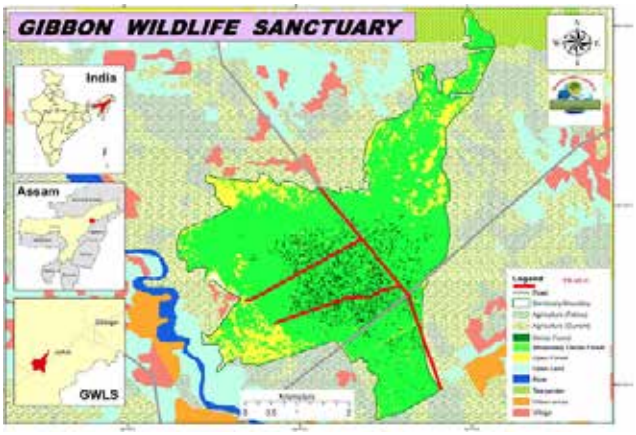
During the exercise, participants were encouraged to select a wildlife or conservation cause they felt personally connected to and design a hypothetical campaign around it. Inspired by Cara's insights and the critical need to protect Assam's unique biodiversity, the Hollongapar Gibbon Wildlife Sanctuary was chosen as the focal point for this campaign.

The exercise aimed to bridge theoretical knowledge with practical application, encouraging participants to think critically about conservation challenges while developing real-world solutions. The resulting #100DaysForHollongapar campaign aims to raise awareness, foster community involvement, and generate actionable support for the sanctuary through 100 days of sustained advocacy, education,

and fundraising efforts. This campaign reflects the passion, creativity, and dedication fostered during the session, underscoring the role of education and mentorship in shaping future conservation leaders.

About the Place: Hollongapar Gibbon Wildlife Sanctuary

Hollongapar Gibbon Wildlife Sanctuary stands as one of Assam's most crucial biodiversity hotspots spanning an area of 20.98 sq. km. Hollongapar is home to an impressive array of wildlife having seven species of primates: The Western Hoolock Gibbon, Stump-tailed Macaque, Northern Pig-tailed Macaque, Eastern Assamese Macaque, Rhesus Macaque, Capped Langur, and the Bengal Slow Loris. It has other mammals like Asiatic Elephants, Leopards, Jungle Cats, Wild Boar, three civet species, and four species of squirrels. At least 219 bird species and 211 species of butterflies are reported from here. The sanctuary also hosts 'Critically Endangered' plant species like Vatica lanceifolia, adding to its botanical significance.



Courtesy: Singh et al. 2015, JoTT (Vol. 7 No. 1).

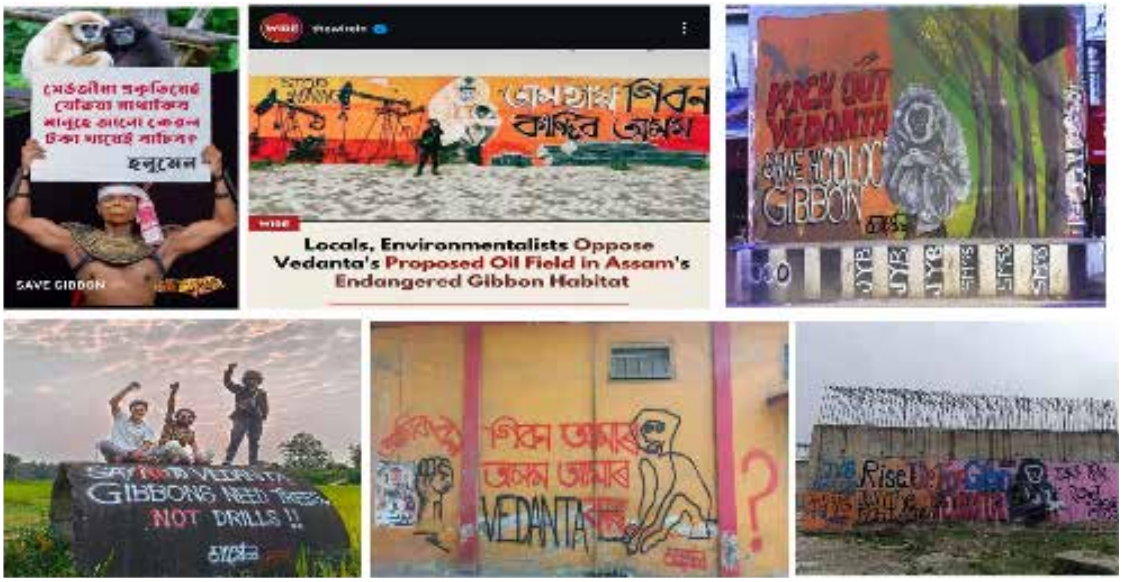
The sanctuary is classified under IUCN Category IV, denoting it as a habitat or species management area, highlighting its importance in conserving species and critical habitats. It lies in a highly fragmented landscape, divided by a single railway line, which isolates wildlife populations and poses risks of human-wildlife conflict. Surrounding Hollongapar is an Eco-Sensitive Zone (ESZ) encompassing Dissoi Valley Reserve Forest, Dissoi Reserve Forest, and Tiru Hill Reserve Forest. These areas together form a crucial buffer that supports wildlife corridors and facilitates the movement of species.

Why the Need for a Campaign? – A little Context

Hollongapar Gibbon Sanctuary (HGS), despite its ecological importance, faces imminent threats that could have irreversible impacts on its biodiversity.

Railway Line Electrification and Expansion:

A 1.65-km un-electrified single railway track cuts through Hollongapar, fragmenting the sanctuary and posing significant risks to wildlife. The ongoing process to electrify this track has raised serious



Courtesy: Marshall Baruah, Himangshu Prasad Das – Facebook

ecocide concerns among conservationists and local communities. Electrification increases the likelihood of:

- Electrocution of arboreal species like the Western Hoolock Gibbon, who frequently cross the canopy over the railway.
- Heightened railway mortality due to animal collisions.
- Habitat disturbance and isolation of wildlife populations.

Furthermore, proposals to convert the single line to a double-track threaten to exacerbate these issues, intensifying habitat destruction and disrupting critical movement corridors. Although the project has been cleared by the National Board for Wildlife (NBWL), the long-term consequences for HGS remain deeply concerning.

Oil and Gas Exploration in the Eco-Sensitive Zone (ESZ):

An Indian conglomerate has been granted Stage 1 clearance for oil and gas exploration on 4.9 ha inside the notified buffer zone of Hollongapar. This buffer, designated as an Eco-Sensitive Zone (ESZ), is critical for maintaining the sanctuary's ecological balance. On 18 October 2024 the NBWL deferred the final permit for the exploration project, reflecting ongoing debate and concern within conservation circles. However, the looming possibility of future clearance poses a dire threat to the sanctuary's biodiversity. Key risks include:

- Deforestation and land degradation during drilling activities.
- Oil spills and contamination of water sources.
- Displacement of wildlife and disruption of ecological processes.

For an already highly fragmented landscape, these projects could accelerate species decline, impact local communities, and undermine decades of conservation progress.

Raising Voices: An Unorganized Campaign

The permit allowing oil and gas exploration within the ESZ surrounding the Sanctuary had sparked public concern and resistance across Assam. Environmentalists, local communities, and wildlife enthusiasts have raised alarms about the potential long-term ecological damage this project could inflict on one of India's most vital biodiversity hotspots. Although initial reactions were fragmented and unorganized, the collective outcry gained momentum as awareness spread through social media platforms and grassroots advocacy. Graffiti artist Marshall Baruah and activist Ankuman Bordoloi were sent to 14-day judicial custody after being arrested after protests involving graffiti.

Local conservation groups have urged state authorities to reconsider the exploration permit, highlighting the risks of deforestation, noise pollution, and possible land degradation that could disrupt the delicate balance within the sanctuary. Many voices also pointed to the sanctuary's fragmented nature, further emphasizing that any disturbances could isolate wildlife populations and escalate human-wildlife conflict in the region.

Organizing the Fight for Hollongapar: Revamping the Campaign

These efforts have laid the foundation for more expansive and organized movements. To formalize this momentum, we introduce #100DaysForHollongapar, a campaign designed to galvanize widespread public involvement, launch fundraising initiatives, and exert political pressure to prevent ecologically damaging projects.

Objectives

Immediate:

- Halt oil and gas exploration activities in the Ecologically Sensitive Zone of Hollongapar Gibbon Sanctuary (HGS).
- Stop the electrification of the railway track that threatens the sanctuary's integrity.
- Generate funds to support ongoing litigation and related activities.

Mid-Term:

- Raise mass awareness about the sanctuary's significance and ecological value.
- Encourage research on the impacts of

habitat fragmentation and environmental degradation in the area.

Long-Term:

- Build widespread public support and legal momentum to enforce stronger environmental protections for HGS.
- Advocate for policies that prioritize ecological conservation over extractive industries in Assam and across India.

Type of Campaign:

The #100DaysForHollongapar campaign will combine multiple strategies to drive action for the sanctuary's protection:

- Mobilizing Youth and Community: Utilize social, electronic, and print media to spread awareness, engage youth, and create viral content.
- Influencing Policymakers: Advocate through lobbying, petitions, and policy briefs to enforce stronger environmental protections.
- Offline Events: Organize Bird Walks, Tree Walks, and Heritage Walks in ecologically important areas across the state to build community involvement.
- Peaceful Demonstrations: Coordinate public protests to raise visibility and show support for the cause.
- Educational Outreach: Engage students (Class 10 and above) through workshops, talks, and educational resources on conservation and biodiversity.
- Fundraising: Raising fund for the community engagement and legal processes.

Timeline

- As the name suggests, the campaign will run for 100 days as a pilot phase. After this period, the campaign's impact will be evaluated, and decisions about expanding or adapting it will be based on future needs and developments.

Home of the Campaign

- The campaign will create #100DaysForHollongapar pages on Facebook, Instagram, and X to engage, inform, and mobilize support across these platforms. We will also have a dedicated website.
- The campaign will leverage these platforms for in-depth posts, events, and community discussions, visual content such as photos, infographics, and short videos, as well as quick updates, hashtags, and real-time engagement with supporters and influencers.

The logo and the face of the campaign

We are using the Hoolock Gibbon as the face of the campaign whose name is ‘Holou’ – the Assamese term for Gibbons, with all supporters of the cause being called 'Guardians of Gibbons'.

Social Media Strategy

- #NotInTheirHome is the centrepiece of the campaign conveying a clear message about respecting wildlife habitats and rejecting actions that disrupt them.
- Asking people to use #NotInTheirHome for posting facts about Gibbons, Hollongapar, and the impact of deforestation.
- Encouraging followers to share pictures of trees and wildlife using the hashtag to spread awareness.
- Create infographics showing the effects of habitat loss on gibbons with the tagline "Habitat Destruction = Extinction: #NotInTheirHome".
- Host a "virtual march" where users upload videos or photos holding signs with #NotInTheirHome written on them.

Slogans and Taglines

- Forests for Wildlife, Not Exploitation: #NotInTheirHome
- Industrial Greed Ends Here: #NotInTheirHome
- Habitat Destruction Stops Now: #NotInTheirHome

- Would you like intruders in your home? Gibbons wouldn't either. #NotInTheirHome
- Development without destruction: #NotInTheirHome
- Social Media Storms: Coordinate mass posts with the hashtags targeting state and national leaders. #WednesdaysForWildlife

Webinars and Virtual Tours:
Host online events featuring experts every Wednesday discussing the sanctuary's biodiversity and conservation needs for 100 consecutive days – focusing on species-wise needs.

Digital Storytelling:
Share stories, photos, and videos highlighting the gibbons and the sanctuary's unique ecosystem. #ArtistsForHollongapar

Asking artists to share their interpretation of the issue, Biodiversity of Hollongapar or any other related artwork.

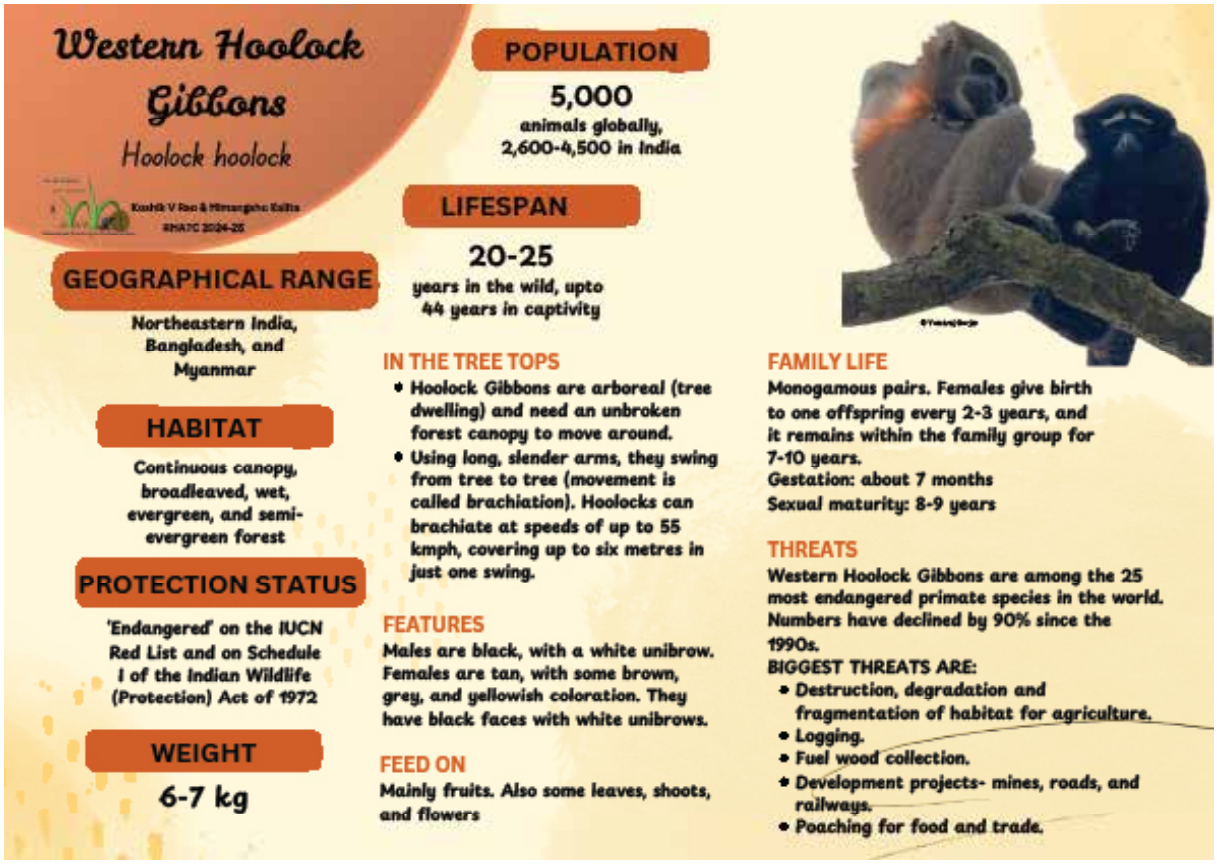
Viral Challenge
Encouraging people to share a video swinging or moving or vocalizing like gibbons to symbolize the need for continuous canopies, with the hashtag #MovesLikeGibbons

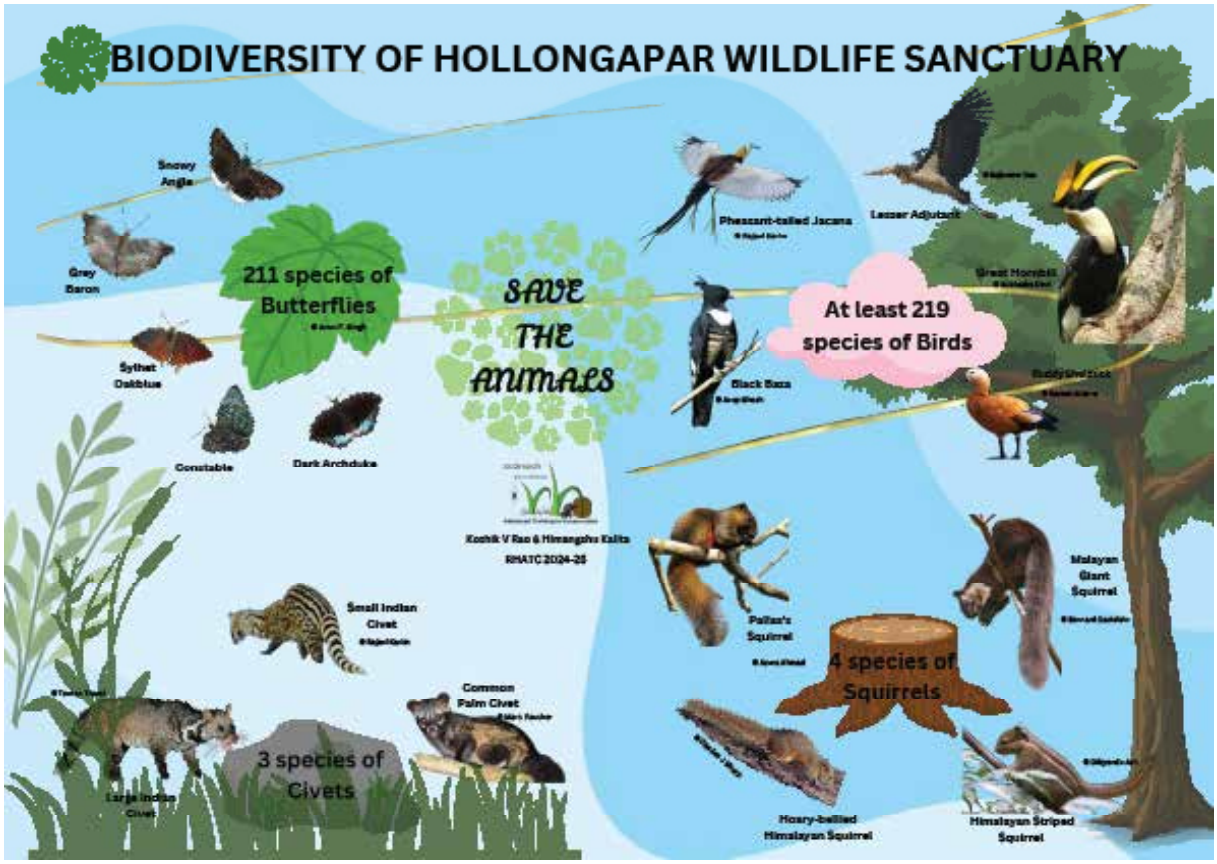
100 Lucky winners to get 'Guardians of Gibbon' caps with campaign logo.

Finding Collaborators

- Core Group: RHATC Fellows 2024-25
- Conservation Educators from different districts of Assam - both rural and urban areas
- People of Assamese film industry, who usually stands for such cause
- Literary Personalities
- Artists
- NGOs
- Educational institutions
- Media Houses
- Local Newspaper Distributor agencies
- We have designed a Band/Paper with the logo of the campaign and a QR Code that will lead to few infographics to create awareness about the issue at hand as well as the biodiversity of the sanctuary to reach maximum people

Infographics and Posters





Donation Drive

- #100RupeesForHoolocks
- #100RupeesForHollongapar

By encouraging individuals to contribute a modest sum of ₹100 to accumulate financial resources to support community engagement programs as well as future needs, such as litigation costs.

Asking people who donated to share the screenshot in the social media with hashtags to inspire others.

Offline Activities

- Community Workshops: Organize workshops in local communities to discuss the importance of HGS & Current Threats it faces
- Educational Outreach: Collaborate with schools and universities to organize seminars, workshops, and discussions about the importance of preserving Hollongapar
- Guided Tree Walks, Nature Walks, Bird Walks and Heritage Walks as part of #WednesdaysForWildlife and discussion therein for HGS.
- Synchronized silent candle march in different cities in Assam as part of #WednesdaysForWildlife to garner public attention to the campaign

In all the offline activities, we will distribute bands with the logo of the campaign, as well as the QR codes to get access to the infographics and posters. We will ask everyone to take a pledge for conservation of wildlife near our own homes and stand together for safeguarding Hollongapar Gibbon Wildlife Sanctuary and the biodiversity within it.

Other Activities

- Launching a campaign on Change.org to attract nationwide attention.
- Press releases to local and national media outlets to highlight the campaign and its objectives.
- Filing a Public Interest Litigation in the Hon'ble Gauhati High Court.

Song of Hollongapar – The Swinging Symphony

In the heart of Assam's green embrace,
Lives a creature with a gentle face.
Hoolock Gibbons swing from tree to tree,
In Hollongapar, wild and free.

Guardians of Gibbons, stand and fight,
Protect their home, preserve their light.
In the forest, hear their call,
Save Hollongapar, protect them all.

Oil rigs threaten their sacred ground,
But together, we can turn it around.
Raise your voice, let the world know,
Hollongapar's future is in our hands to show.

Chorus: Guardians of Gibbons, stand and fight,
Protect their home, preserve their light.
In the forest, hear their call,
Save Hollongapar, protect them all.

Conclusion

The #100DaysForHollongapar campaign has the potential to be a powerful, multi-faceted initiative aimed at protecting the Hollongapar Gibbon Sanctuary and its unique ecosystem. By uniting the community, mobilizing youth, leveraging social media, and engaging policymakers, this campaign strives to halt destructive projects and ensure long-term conservation. Through a blend of awareness, advocacy, and direct action, we aim to foster widespread support for the sanctuary, empowering the next generation of environmental stewards as 'Guardians of Gibbons'. Together, we can secure a future where the Hoolock Gibbons and other wildlife continue to thrive in their natural habitat.

SPARSE BUT NOT SCARCE

Jain Zeal and Shivangi Kanwar Chouhan

This campaign is a response to the solar-hydro power project proposed in Shahabad, Baran district, Rajasthan. The Rajasthan government has approved a proposal by the Greenko Group to clear over one lakh trees for a pumped storage project (PSP) in Baran district, with the Ministry of Environment and Forests (MoEF) granting initial permissions for eight additional projects. These projects will require approximately 3,800 hectares of forest land and involve clearing seven lakh trees in the Aravali and Vindhyachal ranges. To offset the loss of green cover, Greenko plans to plant 6.7 lakh trees in Baran and the Jaisalmer desert region.

This campaign aims to challenge labeling of arid and semi-arid ecosystems as "wastelands" by engaging stakeholders. Assuming, that native vegetation will be lost and introduction of trees in deserts of Jaisalmer would be an ecological disaster. The primary objective focuses on advocating for Greenko'ssolar-hydro power project to undergo mandatory environmental impact assessments (EIA) as required by law, addressing gaps in enforcement, and mobilizing public and legal support to demand compliance.

Raising awareness about the ecological importance of deserts in Jaisalmer and semi-arid landscape in Baran, emphasizing their role in sustaining biodiversity. This will involve education campaigns, partnerships with local communities and environmental organizations, and leveraging media to highlight the significance of these fragile ecosystems.

The education campaigns aim at capacity building in the community, to raise questions regarding the basis of such developments in their region, ensuring Rajasthan government's and Greenko's accountability. These initiatives aim to empower local populations to actively involve in safeguarding their biodiversity.

Arid/Semi-arid Glossary:

Glossary is a medium to mobilize communities by passing on traditional ecological knowledge from older to younger generation while making them aware of the richness of these ecosystems. This awareness amongst the communities can be used to further push lawmakers, MoEFCC and Rajasthan government to denotify ecologically significant arid and semi-arid ecosystems from the Wasteland Atlas of India.

Campaign Posters

These posters question the basis of calling semi-arid regions as wastelands which allows for large scale solar-hydro projects to easily establish. The sparseness of trees in semi-arid regions and bare deserts are fragile ecosystems, often misunderstood for scarcity of biodiversity which results in problematic dense non-native plantations in ecosystems like deserts and semi-arid regions. This leads to ecological disasters both in the location of the solar-hydro project and the compensatory plantation area.

Face of the campaign

Source courtesy: Marginlands by Arati Kumar Rao.

Elephant Burial Grounds Among the Tea Estates of Northern Bengal

In the fragmented landscape of northern Bengal, a fascinating and sensitive behaviour of Asian Elephants *Elephas maximus* has been observed—burying their deceased calves. With human settlements expanding into forested habitats, such unique behaviours come to light. While burial rituals among African Elephants are well-documented, similar behaviours in their Asian counterparts have rarely been studied.

Five cases of Asian Elephant herds burying their dead calves were documented in the tea estates of northern Bengal. The herds were observed carrying the carcasses using their trunks or legs, searching for suitable burial spots, often in irrigation trenches. Remarkably, the calves were buried in a "legs-upright" position. This positioning likely reflects practical considerations, as it makes it easier for the elephants to grip and bury the body. In narrow spaces, it also ensures that the calf's head is buried first.

Footprints around the burial sites indicated that all herd members participated in the process, highlighting the social nature of elephants. Forest guards reported hearing loud vocalizations from the herd during these burials, lasting 30–40 minutes. These sounds may represent mourning and a readiness to defend against potential threats. Such affinity towards the young is attributed to the elephants' strong responses to their long gestation periods and the hormone oxytocin, which strengthens bonds within the herd, especially between mothers and their offspring.

An intriguing behaviour was observed after the burials: the herds completely avoided the burial sites, instead using alternative routes. This contrasts with observations in undisturbed forests, where herds often spend several hours at burial sites and revisit them later. The avoidance behaviour in tea estates highlights how human-altered landscapes can influence elephant social behaviours.

These observations reveal both the adaptability and sensitivity of elephants. Their ability to use human-modified landscapes for such social acts demonstrates their resilience, but it also underscores the impact of habitat loss and human activity on their natural behaviours. Conserving these social animals requires a balance between coexistence in shared spaces and the preservation of their natural habitats.

JoTT article summarized:
Kaswan, P. & A. Roy (2024). Unearthing calf burials among Asian Elephants *Elephas maximus* Linnaeus, 1758 (Mammalia: Proboscidea: Elephantidae) in northern Bengal, India. *Journal of Threatened Taxa* 16(2): 24615–24629. https://doi.org/10.11609/jott.8826.16.2.24615-24629

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The Silent Scavenger and a Clever Predator Vulture: Nature's Scavenger

Vultures are very important to nature. They act as a cleaner by consuming dead animals. However, they are under threat in India. Initiatives are underway by the West Bengal Forest Department with the aim to protect three threatened vulture species. The Vulture Conservation Breeding Centre was set up at Rajabhatkhawa, West Bengal.

Gyps word come from the Greek word Gups, which means "vulture". their names meaning are as follows:

• Oriental White-rumped Vulture *Gyps bengalensis*, the bengalensis word refers to Bengal, hinting at its geographic range.
• Long-billed Vulture *Gyps indicus*, the indicus word relates to India, marking where it was described from first.
• Slender-billed Vulture *Gyps tenuirostris*, the tenuirostris word translates to 'slender beak', describing its distinct feature.

This centre also rescues and rehabilitates vultures ensuring their survival and reintroduction into the wild. The pre-release aviary of centre where captive bred vultures from the breeding centre are kept and acclimatized before being released in to the wild. This site is frequently visited by Himalayan Griffon Vultures (primarily resident of Himalaya mountains) and they interact with captive-bred vultures, showing their social behaviour.

Eat Or eaten?

The Centre provides carcasses of naturally dead animals near the pre-release enclosure, in the feeding site. This method helped to attract wild vultures and supports the released vultures (captive-bred and rescued ones) during their initial days. All carcasses are checked for diseases. While monitoring the vultures at the Centre, an unexpected event occurred in February 2020, a Himalayan Griffon Vulture was killed by an Indian Leopard *Panthera pardus fusca*. The vulture was feeding on a Sambar Deer carcass near the pre-release feeding ground when the leopard attacked and dragged it away. It was recorded in the camera trap placed in feeding site for monitoring. The drama didn't end there; four years later, in March 2024, two more vulture carcasses were found, likely victims of leopard predation. Adult vultures are usually safe from predators, this was an unusual sight implying the nature doesn't always go as planned.

Clever Leopard or new predator!

Leopards in Buxa are very much adaptable to living in forests, hills, tea gardens, and even near the human settlement areas. Their diet includes various animals and wild bird including peafowls regularly in different protected parts of India, but predation on vultures is rare and previously unreported. To the observation and best knowledge of the authors of this article, this is the first documented sight of Indian Leopards preying on Himalayan Griffon Vultures in their natural habitat.

Need more study:

More research is needed to understand leopard diets in vulture habitats. This could reveal whether vultures are becoming a common prey of leopard or this was an unusual occurrence.

JoTT article summarized:

Chakraborty, S.S., D. Ray, A. Sen, P.J. Harikrishnan, N.K. Jha & R. Ghosh (2024). Indian Leopard predation on the sub-adult Himalayan Griffon Vulture (Accipitridae: Accipitriformes). *Journal of Threatened Taxa* 16(11): 26104–26109. https://doi.org/10.11609/jott.9255.16.11.26104-26109

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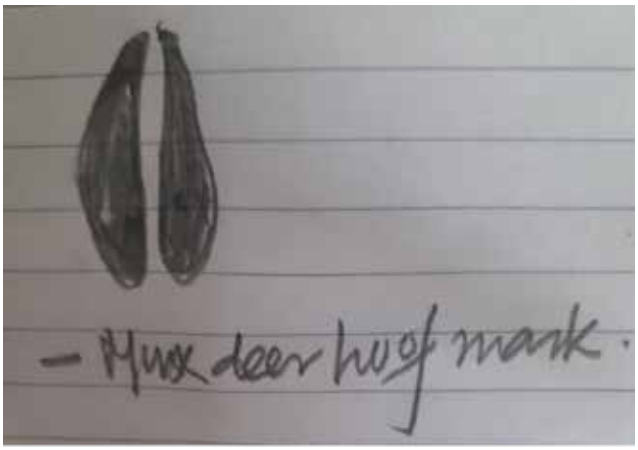
Fragrance of Himalaya: The Story of the Lost Himalayan Musk Deer from Sakteng Wildlife Sanctuary, Bhutan

'Nature always has surprises for us and the discoveries are even more beautiful'.

The Himalayan Musk Deer *Moschus chrysogaster* is distributed from highlands of central china to the India, Pakistan, Nepal, and Bhutan across the Himalayan region. The distribution of Himalayan Musk Deer is informed to be few because of the habitat fragmentation and the hunting pressure. It's listed as the Schedule I species of Nature Conservation Act of 1995, that provides the maximum protection to the species.

Himalayan Musk Deer. © Mohsin Ahmad.

It was suggested that the Himalayan Musk Deer was locally extinct from the Sakteng Wildlife Sanctuary (SWS) due to the habitat degradation, from livestock grazing (grazing reduces food, spreads diseases, and creates competition with wildlife, causing their population to decline), and hunting for musk pod which is used for medication and perfumes, these factors were the eye openers for the scientific community and this led to the establishment of the Sanctuary in 2003, SWS is on the eastern border of Bhutan. A survey was conducted in the same region and presence of three Himalayan Musk Deer was reported in 2014. The SWS is one of protected regions of the Himalaya which is home to the many rarest and globally threatened wild flora and fauna.



Hoof mark. © Mohsin Ahmad.

It's the only protected region with the highest diversity of Rhododendron species in the Bhutan. The study was conducted from the broadleaved plants with bigger leaves to alpine zone where plants have spiny like leaves, less vegetation, high altitude and cooler temperature with the altitude ranging from 1,584 m to 4,488 m. In the area of 10 sq m two camera traps were placed and the total area

Pellets of musk deer. © Mohsin Ahmad.

Simplified meaning of a few terms:

Moschus chrysogaster	*Moschus* derived from greek word 'moskhos' meaning musk and *chrysogaster* means golden belly.
Habitat fragmentation	The large forest area was divided into patches like by building roads, farms, houses,
Schedule I species	These kind of species get the highest level of legal protection by ban on hunting, capturing or trading.
Locally extinct	Due to the continuous hunting and humans disturbing their habitat, the populations no longer exists.
Wildlife Sanctuary	Area where animals and their habitats are kept safe from harm like hunting or destruction. People can visit or study these areas, but without disturbing the animals.
Camera traps	Cameras that click pictures when anything passes by.
Endangered	It is threatened in its distribution and classified under the threat category of the IUCN Red List.
Genetic inbreeding depression	When closely related animals or plants breed among themselves which lead to health issues.
Genetic traits	These are characteristics, like size, colour, or behaviour, that are passed down from parents to offspring.

surveyed was 740.60 sq km. The camera traps were placed at the place for five months from November 2014 to March 2015. The presence of the indirect evidences like pellets and hoof marks (Image 2) also indicated the presence of Himalayan Musk Deer.

Apart from the Himalayan Musk Deer other predator species like Royal Bengal Tiger, Himalayan Black Bear, and Common Leopard were captured in the camera trap. The species of the musk deer which captured in the southern and southeastern parts of Merak Range under SWS were the first ever recorded in the region.

Himalayan Musk deer is declared as Endangered on the IUCN Red List of Threatened Species due to its high poaching for the musk pod. The main threat to the Himalayan Musk Deer in SWS is competition from the large herds of free ranching livestock of 'Brokpa' the semi-nomadic inhabitants of the place who come to the alpine meadows during summer and this causes competition for resources leading to population decline of the Himalayan Musk Deer.

Another problem that the species may face is the genetic inbreeding depression as the area of the sanctuary is limited which may lead to the loss of potential genetic traits in the species.

JoTT Article summarised:

Tobgay, S., T. Wangdi & K. Dorji (2017). Recovery of Musk Deer *Moschus chrysogaster* Hodgson, 1839 (Artiodactyla: Moschidae) in Sakteng Wildlife Sanctuary, Bhutan. *Journal of Threatened Taxa* 9(11): 10956–10958. https://doi.org/10.11609/jott.3280.9.11.10956-10958

Mohsin Ahmad
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Wetland Ecosystems and Their Conservation: Case Study of Therthangal Bird Sanctuary, Tamil Nadu

Wetlands are vital ecosystems that support diverse life forms, including humans. The Therthangal Bird Sanctuary, located in Ramanathapuram district, Tamil Nadu, exemplifies this importance by hosting a rich variety of bird species. Recent studies reveal that this rainfed wetland, despite facing threats from human activities, plays a crucial role in biodiversity conservation, especially as a breeding ground for waterbirds.

Key Study Insights

A two-year study (April 2021–March 2023) at the sanctuary recorded 96 bird species across 44 families and 18 orders. Notably, 40 waterbird species were observed, with 23 breeding on-site. The study also documented four 'Near Threatened' species like Oriental Darter, Black-headed Ibis, Asian Woolly-necked Stork, and Spot-billed Pelican. Improved rainfall in the second year led to a rise in nesting activities.

The sanctuary supports ecological balance by aiding processes like nutrient cycling, seed dispersal, and pest control, benefiting both wildlife and local communities.

Conservation Challenges

The Sanctuary faces significant threats. Invasive plants like *Prosopis juliflora* and *Ipomoea carnea* are displacing native vegetation. Irregular rainfall causes tree wilting, reducing nesting options, while nearby agricultural practices, including pesticide use and cattle grazing, add pressure. Conflicts over water usage and poorly defined boundaries between the sanctuary and villages further complicate conservation efforts.

The Path Forward

The Sanctuary's role as a haven for birds and provider of ecosystem services emphasizes the need for urgent conservation measures. Strategies like removing invasive species, restoring habitats, managing water resources sustainably, and engaging local communities are critical. Collaboration among stakeholders will ensure the Sanctuary's long-term preservation, benefiting both biodiversity and human well-being.

JoTT Article summarised:

Byju, H., H. Maitreyi, N. Raveendran & R. Vijayan (2024). Avifaunal diversity assessment and conservation significance of Therthangal Bird Sanctuary, Ramanathapuram, Tamil Nadu: insights about breeding waterbirds. *Journal of Threatened Taxa* 16(9): 25802–25815. https://doi.org/10.11609/jott.8999.16.9.25802-25815

Sidharthan

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Adding a Dragonfly to my menu

Who am I?

Hey there! I'm *Orthetrum sabina*, but folks call me the Green Marsh Hawk or the Slender Skimmer. I'm a medium-sized dragonfly, and I love to hang around calm water bodies, hunting smaller insects. You can spot me easily with my greenish-yellow body and bold stripes across my thorax. My abdomen has black and reddish-brown spots on my wings that are about 30–36 mm long, just like my body! My eyes are green with black markings, aiding my striking presence.

As for the ladies, they look quite similar to me but with a bit of a twist. Their abdomens are a slightly thicker abdomen, around 32–35 mm long, while their wings are 31–35 mm. But we both share the same eye color and wing spots. Isn't that cool?

Where you can find me?

I'm pretty well-traveled, actually! I am found all over southern and eastern Asia, Australia, Micronesia, and even stretches up to northern Africa.

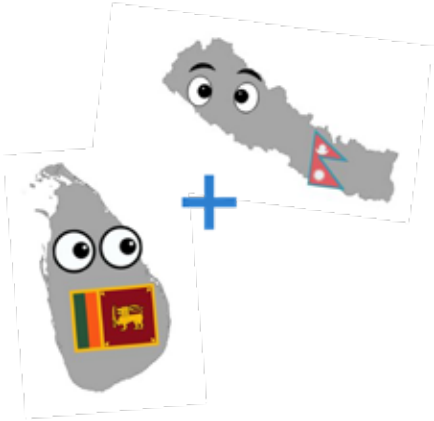
Do you know my widespread throughout these regions classified me as 'Least Concern' on the IUCN Red List, which means we're doing okay! You'll find us hanging around various water bodies, like, slow-flowing streams, still ponds, marshes, and even paddy fields. We can also be spotted from sea level all the way up to 2,300 m elevation. But we're not just water lovers—we can often be seen perching away from the water, on garden plants, branches, twigs, rocks, and even the ground. We're pretty adaptable too, thriving in different climates and elevations. Plus, we can tolerate high salt levels and even habitat changes or disturbances. Not bad for a dragonfly, right?

Curious About My Hunting Style?

Getting inspired from Edward Osborne Wilson said, *"The more we learn about the intricate details of natural ecosystems, the more we can appreciate the interdependence of species."* several researchers have taken an interest in studying my feeding behavior. Now, let's talk about it. I am quite the hungry dragonfly and I eat a wide variety of insects, sometimes smaller damselflies, although they're not my first choice because they don't offer much food. Studies have shown me preying on butterflies.

Let's track my diet from Sri Lanka to Nepal

I'm known to be quite the predator and yes, even from my own family Libellulidae like *Neurothemis tullia* also known as Pied Paddy Skimmer! Recently, Gamage in 2023 reported spotting me feeding on paddy skimmer in Sri Lanka. A few years earlier, Sharma & Oli in 2020 mentioned seeing me do the same in the Palpa District of Nepal, but they didn't go into much detail. That's where Mahamad Sayab Miya & Apeksha Chhetri came in – they made a dedicated effort to study my feeding behavior, and guess what? They finally spotted me hunting *N. tullia* in Nepal as well in 2024! What's interesting is that these two areas are quite far apart.



Do you want to know how they studied this?

The observation took place during a survey at Maidi Lake in Pokhara Valley, on 30 July 2022. Researchers laid three 200-m long straight line to collect data once a month from July to December 2022 between 10:00 h and 15:00 h on sunny days. During the survey, they photographed my chomping on *Neurothemis tullia*, using a smartphone and identified later with field guides.

Want to know how I chomp on my meal?

I start by chewing the head and then move down through the body parts. I hold my prey with my forelegs while perched on an herbaceous plant. Surprisingly, I didn't fly away even when the researchers approached to take a photograph. The entire feeding process lasted over 15 minutes and took place about 3 meters away from the water body. Cool right?

Want to know what is special about this study?

But what makes my story even more interesting is how my feeding behaviour has been observed in two places that are miles apart – Sri Lanka and Nepal. Not only far from each other but also have distinct biogeography. Sri Lanka, with its tropical climate and Nepal from the lowlands to the high mountains, couldn't be more different. Yet, in both places, I was spotted feeding on *N. tullia*, a behaviour that piqued the interest of researchers around the world. there's clearly a pattern, suggesting that more studies are needed to fully understand my feeding behaviour.

Hold on tight, folks-there's more to my feeding story waiting to unfold!

JoTT article summarized:

Miya, M.S. & Chhetri, A. (2024). Additional documentation of the Slender Skimmer *Orthetrum sabina* (Drury, 1770) preying on the Pied Paddy Skimmer *Neurothemis tullia* (Drury, 1773) in Nepal. *Journal of Threatened Taxa* 16(9): 25935–25938. https://doi.org/10.11609/jott.9260.16.9.25935-25938

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Epiphyte Diversity in Tea Plantations of West Bengal

Epiphytes, these plants do not grow in soil but rely on structural support from other surfaces, either living (like trees) or non-living (like rocks), provided there is sufficient moisture.

Epiphytes are classified into four types on the basis of their life forms as follows:

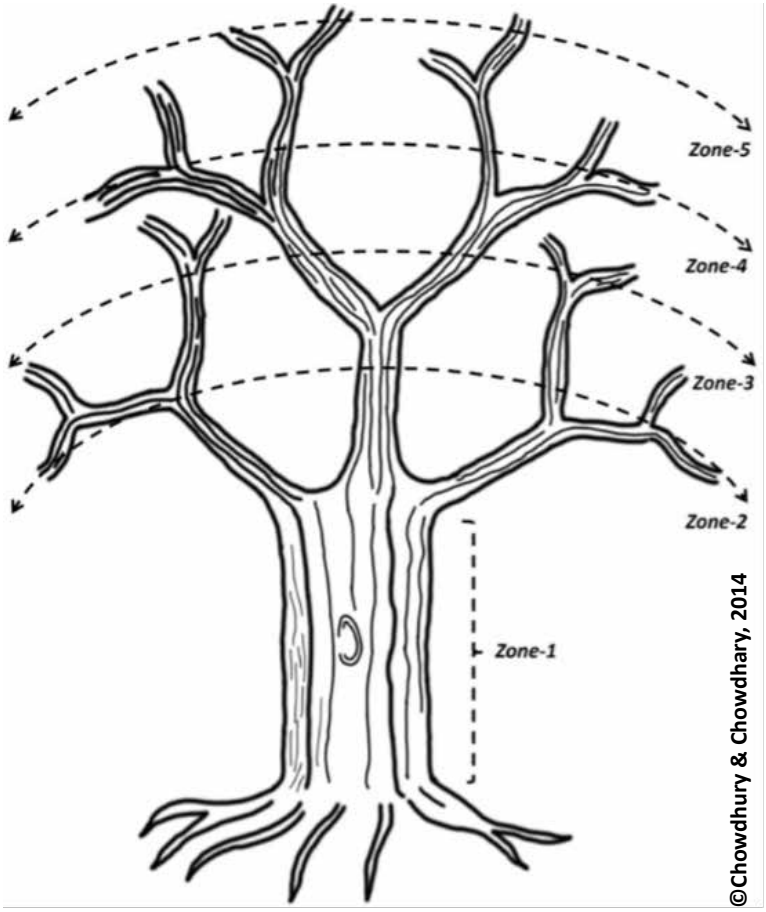
- Holo epiphytes: true epiphytes growing on host trees.
- Hemi epiphytes: first grow as a terrestrial plant and later adapt an epiphytic life form.
- Facultative: not true epiphytes – can grow as a terrestrial or as an epiphyte.
- Accidental: true terrestrial plants accidentally growing on host tree.

The study sites are the Terai and Doar tea gardens in West Bengal. They are predominantly tropical evergreen forests surrounded by numerous rivulets. The moist climatic condition, with an annual rainfall of 120–350 mm and a relative humidity of 99.4% support significant epiphytic biodiversity.

One measures the species diversity, abundance and the composition by measuring the status (commonly found, abundant or rare), zone preference, host preference, and distribution across different locations in region of the study.

Vertical stratification method by Johansson (1974) was used to analyse the **zone preference.** Vertical distribution of epiphytes on the host(tree) was studied. Host was divided into five zones as shown. Classification of species was done on the basis of which zone they occurred in. The data shows that the middle canopy layer hosts the highest diversity of epiphytes, while diversity declines towards the treetop. Zone 2 recorded the greatest abundance of both hemi epiphytes, holo epiphytes and accidental, followed by Zone 3. Zone 5 has lowest of all the classified epiphytes. Among the identified epiphytes, ferns and orchids dominated.

Interpolation and extrapolation analysis was used to assess whether species diversity were influenced by the different hosts and therefore the host preference. The analysis also evaluated how well the sampling effort represents the diversity of vascular epiphytes on different tree species.



Zonation diagram

Vascular epiphytic species richness, abundance, and composition were high on these dominant shade trees in the tea gardens, such as H1 – *Mangifera indica*, H2 – *Albizia lebbeck*, H3 – *Gmelina arborea*, H4 – *Ficus benghalensis*, H5 – *Alstonia scholaris*, H6 – *Albizia odoratissima*, H7 – *Artocarpus chama*, H8 – *Swietenia mahagoni*, H9 – *Dillenia pentagyna*, and H10 – *Litsea glutinosa*. The data shows that H1, H2, H5, H6, H7, H8, H9, & H10 had more than 50% sample coverage area of vascular ephiphyte assemblages (VEAs). In comparison, H4 and H3 had 17% or less than sample coverage.

Further, **Diameter at Breast Height (DBH) analysis** examined the *variation in epiphyte abundance relative to tree girth*. The results show that the VEA was lowest on trees with a DBH of 1–2 m, peaked at 3–5 m, and saturated at 6–7 m. This indicates that DBH is a critical factor influencing the abundance and species richness of epiphytes in the study area.

In conclusion, the moisture-rich conditions of the tea gardens, combined with their diverse shade trees, make them a hotspot for epiphytic diversity. This interplay of environmental factors and host characteristics plays a pivotal role in shaping the epiphytic ecosystem.

JoTT article summarized:

Chowdhury, R. & M. Chowdhury (2024). "Diversity of vascular epiphytes on preferred shade trees in tea gardens of sub-Himalayan tracts in West Bengal, India. *Journal of Threatened Taxa* 16(8): 25720–25729. https://doi.org/10.11609/jott.8660.16.8.25720-25729

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NATURE'S SECRET CODE

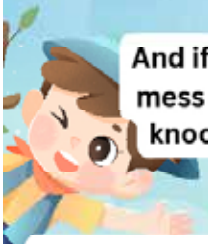
Exploring Aquatic Life with eDNA

Have you heard of eDNA? It's a supercool tool that can help us track biodiversity by studying tiny DNA bits left behind in water or soil! it's like a magical spyglass for nature!

eDNA comes from many sources—like skin cells, poop, slime, or even dead animals—and we can find it in water, air, or soil! it's like nature's hidden diary!

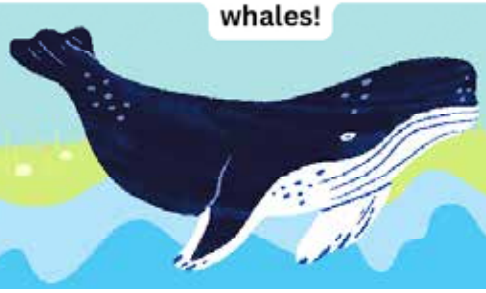
With eDNA, we can check if a species is present or even estimate how many there are—without disturbing the animals!

Did you know we've only discovered a small fraction of all the species on Earth? So many creatures are disappearing before we even know they exist!



And if one species vanishes, it could mess up the whole chain of life, like knocking over a line of dominoes!

Traditional ways of counting species aren't perfect—they can miss some and even harm delicate creatures during the process. Ecosystems like rivers, oceans, and lakes are teeming with life, from tiny microbes to giant whales!



eDNA doesn't last forever in the wild. It can stick to stuff, sink, or even break apart! Temperature, salinity, and even sunlight decide how long it stays.

The size of the filter we use for eDNA is super important—it decides what kind of DNA we'll catch, like cells, slime, or even free-floating DNA! So, filters are like special nets for invisible clues!

Guess what? eDNA can do way more than just detect species—it can help us study entire ecosystems and how they're changing over time! It's like a giant puzzle piece for conservation.

We're not just finding out who's there—we can even estimate how much biomass* or DNA is around, thanks to advanced methods.

*Living weight

But watch out—sometimes eDNA can trick us! Dead animals or undigested food might give false signs of life. And contamination during testing can mess things up, too!

False negatives are also a problem. Sometimes we don't detect an organism even when it's there. That's why replicates and optimized methods are key! We can avoid errors by sampling multiple times, following protocols carefully. So, science needs patience and precision—got it!?

eDNA is a powerful tool for monitoring biodiversity, especially in a changing world. By combining it with traditional methods, we can protect species and ecosystems more effectively!

THIS CONTENT IS ADAPTED FROM THE PAPER TITLED "ENVIRONMENTAL DNA AS A TOOL FOR BIODIVERSITY MONITORING IN AQUATIC ECOSYSTEMS - A REVIEW" BY RAY, M., & G. UMAPATHY (2022).

IT HAS BEEN SIMPLIFIED AND REWRITTEN TO MAKE IT ACCESSIBLE AND EASY TO UNDERSTAND FOR A GENERAL AUDIENCE, WITHOUT TARGETING ANY SPECIFIC AGE GROUP.

Ray, M. & G. Umapathy (2022). Environmental DNA as a tool for biodiversity monitoring in aquatc ecosystems – a review. *Journal of Threatened Taxa* 14(5): 21102–21116. https://doi.org/10.11609/jott.7837.14.5.21102-21116

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Conservation After Conflict: How Wildlife is Adapting in Manas National Park

Political Conflicts Reshaping Wildlife

Political conflicts and insurgencies, though primarily involving human groups, have impacts that reach far beyond people, affecting wildlife, ecosystems, and the environment. Armed conflicts make conservation efforts much harder. While some studies suggest that conflicts might occasionally benefit wildlife, such as reducing human pressure on animals when people avoid conflict zones or slowing down harmful industries, the negative effects are more significant. These include direct harm to animals from weapons, chemicals, increased hunting by parties involved and habitat destruction. Recent studies from Africa show that as conflicts increased, populations of large mammals dropped significantly, and many species are struggling to recover. Given these challenges, it's essential to understand how conflict affects wildlife in order to guide conservation efforts and help these species recover.

A Mayhem in Manas: The Impact of Ethno-political Conflict on Wildlife

Manas National Park (MNP) is located in the state of Assam, India, within the eastern Himalayan biodiversity hotspot. It is contiguous with the Royal Manas National Park of Bhutan, creating a vast habitat for wildlife encompassing two countries. The region was severely affected by ethnopolitical conflict from the late 1980s until 2003, which caused widespread damage to the park's habitats, wildlife, and conservation efforts. This unrest disrupted the protection of the park, destroyed natural habitats, and led to a significant decline in wildlife populations. During this time, the Indian Rhinoceros was poached to the point of extinction in the park, requiring a re-introduction program to bring the species back. Although political stability began in 2003, occasional ethnic conflicts continued in the region almost till 2016, affecting one of the ranges of the park.

Path to Recovery: Long-Term Research and Monitoring for Enhanced Conservation

Wildlife monitoring with camera trapping in MNP began in 2010, covering a few areas. It is a method used to capture images of wildlife in their natural habitat. It involves setting up cameras with motion sensors in areas where animals are likely to pass. When an animal triggers the sensor, the camera takes a photo or video, allowing researchers to observe and monitor animal species without disturbing them.

However, it was only in 2017, due to the current study, that comprehensive camera trap surveys were conducted simultaneously across all three ranges of the park. This study focused on mammals - which are warm-blooded animals with backbones, fur or hair, and the ability to produce milk for their young with an aim to document their diversity as well as to understand how civil conflict affected them.

Key Takeaways from the Study

• Methods followed and results

Survey Duration and Method: A camera trapping survey was conducted from 28 December 2016 to 24 February 242017, across three forest ranges in MNP - Panbari, Bansbari, and Bhuyanpara.

Camera Setup: Cameras were set up on trees and poles, inside steel cages, to prevent damage from wildlife. A total of 118 camera trap locations were used.

Data Collection: Cameras were active 24 hours a day, capturing images of animals. Camera traps were active for 6,173 trap-days (No. of cameras used x Total no. of days). The images were downloaded regularly, and experts identified the species,

capturing 21,926 photographs of 25 mammal species from 13 families.

Comparing Different Areas: The study compared the mammalian prey and predators between two areas (Panbari vs. Bansbari-Bhuyanpara) to understand how wildlife populations differ across the park.

Capture Rate: The study calculated how often different species were captured by the cameras (called the photo-capture rate index or PCRI), helping to understand the abundance of species in different areas. It was found that mammalian prey species had lower capture rates in the Panbari area compared to the Bansbari-Bhuyanpara areas, while large carnivores like Wild Dogs were captured more in Panbari.

Species Mapping: The data was used to map where different species were found in the park, showing spatial differences in wildlife distribution.

Statistical Analysis: A statistical test was used to see if there were significant differences in capture rates between the two areas, considering the possible errors in data. There were significant differences in the capture rates of four species - Barking Deer, Sambar, Gaur, and Wild Dog between the two areas.

• Inferences and Discussions

Wildlife Presence and Monitoring: Despite years of conflict, most mammal species expected in Manas National Park were found during the study, except for a few species like the Sloth Bear and Fishing Cat. This suggests that the number of species in the park has remained mostly intact.

Impact of Conflict on Species: The study found differences in the number of animals detected in different parts of the park. Areas that experienced less conflict (Bansbari and Bhuyanpara) had more herbivores like wild buffalo and gaur, which are also at risk of poaching. Areas with more conflict (Panbari) had higher numbers of large carnivores like wild dogs, possibly because they avoided human activity in the conflict zone.

Refuge for Carnivores: The nearby Royal Manas National Park in Bhutan may have served as a safe haven for large carnivores like tigers, which then moved into the Panbari range of Manas once security improved. This highlights the importance of connected wildlife areas for supporting animal populations.

Limitation of the study

Camera traps were mostly successful in documenting some species. However, it did not capture some species groups like rodents, arboreal (tree-dwelling), and aerial mammals. However, direct observations confirmed the presence of three primate species: Capped Langur, Golden Langur, and Rhesus Macaque. Additionally, other species were recorded during long-term monitoring, including Black Giant Squirrel, Himalayan Striped Squirrel, and Pygmy Hog. Another limitation comes in the form of lack of comparable data on mammal distribution prior to the conflict, which made it impossible to directly compare the pre- and post-conflict effects on species abundance and distribution.

While the study suggests conflict has impacted wildlife distribution, further research is needed to fully understand how conflict and peace affect species populations over time. This will help improve conservation efforts in the park and beyond.

JoTT article summarized:

Lahkar, D., M.F. Ahmed, R.H. Begum, S.K. Das, B.P. Lahkar, H.K. Sarma & A. Harihar (2018). Camera-trapping survey to assess diversity, distribution and photographic capture rate of terrestrial mammals in the aftermath of the ethnopolitical conflict in Manas National Park, Assam, India. *Journal of Threatened Taxa* 10(8): 12008–12017. http://doi.org/10.11609/jott.4039.10.8.12008-12017

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The Need for Conservation Laws Coherent with Communities for Success

The **Chiru**, an antelope native to the open alpine and cold steppe environments of Jammu & Kashmir in India, is a remarkable sight in the wild. However, human practices threaten its survival, raising the risk that future generations may never witness this magnificent creature.

The Chiru's fur is distinctive, consisting of long guard hairs and a silky undercoat of shorter fibers. Its fur is exceptionally soft and warm, making it highly sought after for the production of Shahtoosh shawls. Unfortunately, this demand has driven the species to the brink of extinction. Recognizing this threat, the Indian government, under the Wildlife (Protection) Act [WPA] of 1972, banned the trade of shahtoosh in 2002. The WPA is an act to protect species which are placed under different schedules. While this was a positive step for conservationists, it disrupted the livelihoods of many locals, as tourism and handicrafts are critical sources of income in the region.

The trade in shahtoosh is fraught with challenges and bitter truths:

1. Many members of the public are unaware of the origins of shahtoosh wool, often misled by false propaganda.
2. Weavers are grossly exploited by a handful of powerful traders.
3. The chiru wool trade frequently operates on a barter system, bypassing fair economic practices.

Despite the ban, illegal trade in shahtoosh continues and this persistence highlights the failure of conservation efforts to consider the intricacies of regional politics and the exclusion of local communities in policy implementation.

To address these issues, the concept of Joint Forest Management (JFM) was introduced. This initiative aimed to involve diverse stakeholders, including forest officials, local communities, and politicians, in conservation efforts. While the shahtoosh ban disrupted the local economy, JFM sought to provide alternative livelihoods but unfortunately, both initiatives fell short of their goals due to various implementation challenges.

These experiences serve as a critical lesson for conservationists: sustainable conservation policies must be grounded in local realities, ensuring long-term success by balancing ecological needs with the socio-economic well-being of affected communities.

Disclaimer- This content has been written by referring to a scientific article titled "The need of conservation laws coherent with communities for complete success" by Ramanan & Upadhyay (2018).

Reference

Ramanan, S.S. & L. Upadhyay (2018). The need of conservation laws coherent with communities for complete success. *Journal of Threatened Taxa* 10(8): 12144–12145. https://doi.org/10.11609/jott.4262.10.8.12144-12145

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ZOO'S PRINT

Communicating science for conservation

ZOO'S PRINT Publication Guidelines

We welcome articles from the conservation community of all SAARC countries, including Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka and other tropical countries if relevant to SAARC countries' problems and potential.

Type — Articles of semi-scientific or technical nature. News, notes, announcements of interest to conservation community and personal opinion pieces.

Feature articles — articles of a conjectural nature — opinions, theoretical, subjective.

Case reports: case studies or notes, short factual reports and descriptions.

News and announcements — short items of news or announcements of interest to zoo and wildlife community

Cartoons, puzzles, crossword and stories

Subject matter: Captive breeding, (wild) animal husbandry and management, wildlife management, field notes, conservation biology, population dynamics, population genetics, conservation education and interpretation, wild animal welfare, conservation of flora, natural history and history of zoos. Articles on rare breeds of domestic animals are also considered.

Source: Zoos, breeding facilities, holding facilities, rescue centres, research institutes, wildlife departments, wildlife protected areas, bioparks, conservation centres, botanic gardens, museums, universities, etc. Individuals interested in conservation with information and opinions to share can submit articles ZOOS' PRINT magazine.

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Publication Information

ZOO'S PRINT, ISSN 0973-2543
Published at: Coimbatore

Owner: Zoo Outreach Organisation, 3A2 Varadharajulu Nagar, FCI Road, Ganapathy, Coimbatore, Tamil Nadu 641006, India.

Editor: Sanjay Molur
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ZOO'S PRINT magazine is informal and newsy as opposed to a scientific publication. ZOO'S PRINT magazine sometimes includes semi-scientific and technical articles which are reviewed only for factual errors, not peer-reviewed.

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RHATC 2024–25 is funded by

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