ZOO'S PRINT

Communicating science for conservation

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Cover photo: ***Indrella ampulla***, Coorg, India. © Diya Banerjee.

Conservation in Action: Exploring Ground Realities in the Western Ghats with RHATC

We were very excited when Sanjay announced the first field trip as part of the Ram Hattikudur Advanced Training in Conservation (RHATC) course 2024–25. We were thrilled to be there in the laps of the Western Ghats after spending so much time inside the classroom learning about conservation. Expectations were overflowing. Yeah, finally we started our journey to Coorg by 4.30 am from Coimbatore on 01 November 2024. It was a lot of surprises right along the trip as we were not told about the destinations. The excitement and expectations varied from person to person. Some of us were eagerly waiting to see leeches, some not so much! Of course, there were a few of us who had been to the Western Ghats before, but most of us were new to the forests of Southern India.

Day 1

Rainforest Retreat

The Rainforest Retreat's Mojo Plantation is a unique project that combines eco-tourism with sustainable agriculture and environmental education. It is an organic farm in the Tropical montane rainforests of the Western Ghats of Kodagu district in Southern Karnataka. Mojo Plantation was founded in 1994 by Drs. Sujata and Anurag Goel. Together with their daughter Maya, they made this very special rainforest environment their home. Sujata has a PhD from the Botany Dept of Delhi University and Anurag completed his studies (PhD in Molecular Biology) in Toronto, Canada. While talking to them, we came to know about their previous research experience in the fields of biological

sciences including botany, plant biochemistry, genetics, ecology and molecular biology. They have lived and worked there for over 25 years developing Mojo plantation as a model for conservation through agro-ecology and sustainable tourism. Their conservation efforts have been recognized by a recent award from Carl Zeiss Foundation and Sujata has been a very active member of OFAI (Organic Farmers Association of India). As OFAI president she hosted the World Organic Congress held in Delhi in 2017.

Income from the Rainforest Retreat funds the activities of the WAPRED Research Foundation (Worldwide Association for Preservation and Restoration of Ecological Diversity), an environmental NGO.

We began our field trip with a hot lunch followed by a cold dip in the stream originating nearby. Wildlife was omnipresent, from sighting a cicada molt on the plastered steps to snails on lily-like leaves, slugs, stick insects landing on the back, female *Nephilia pilipes* spinning and spanning her web across leaves and male sitting still on the web and another Nephila feeding on *Dysphania percota* commonly called the Blue Tiger Moth. All of this was found while moving just around the dining area.

We headed to walk one of the valleys, moving through dense canopies of *Eleocarpus* sp. commonly referred to as Rudraksh, *Syzigium* sp., non-native *Acacia* sp. to sparsely spaced stunted trees to plantations as we ascended to the shola grasslands, now rapidly declining. The shade of the Eleocarpus trees and others sheltered the coffee, pepper, cardamom, avocados, vanilla, etc. This was a great start in familiarizing us with the place and its biodiversity. It rained and it was ideal for mating of frogs. We spotted a significant number of frogs and toads near the lodge most often residing within the lily leaves.

DAY 2

Mushroom Foraging & Ridge Walk

The next day, we headed to forage for mushrooms and found a magnificent green beetle with pronounced eyes clenching onto grass called as *Lytta vesictoria* commonly known as the Spanish fly. We walked and reached a place where an Eleocarpus tree had fallen and mushrooms were mushrooming there. We learned which ones to pick and which ones

to let be. We saw three kinds of mushrooms, brown, white, and pink. We plucked the white ones from the base, let the pink ones be since they were very few, and let the brown ones be since they were mature hence allowing it to sporulate and reproduce more. A mature mushroom has gills below which are spaced out enough and tightly packed gills indicate that they are still maturing. We saw a snail gorge on a mushroom. The key lesson was to always leave behind enough because it's also somebody else's food and leave room for sporulation and reproduction. Robin Wall Kimmerer would've been proud.

How does one decide if the mushroom is edible or nonpoisonous? How does one identify mushrooms? Mushrooms sold in the local market were one of the key indicators to decide if it was edible and ID'ing wasn't used to understand its edibility. Mycologists use a spore print to ID the mushrooms, a photo of the mushroom is not enough to ID. The spore print is taken by allowing a mushroom to mature and sporulate covered with a glass.

We then headed for the Ridge Walk. We walked through the dense foliage of tall trees in the valleys, shrubs and then coffee and pepper plantations as we ascended to the the grasslands. We witnessed the remnants of the 2018 landslides and its effect on the ecology. It wiped out most of the topsoil and vegetation along with it. After all these years those escarpment-like edges are beginning to get mosses and lichen making a ground for grasses followed by other vegetation growth. Sadly, millions of years of wildlife washed away. Why? Lots of rainfall, loss of 300–1000-year-old tussocks which constitute the grassland. Tussock stores more carbon for its body size in proportion to trees and manages to hold the soil much better because of its fibrous roots. We saw betelnut palms and acacias non-native to Coorg, replacing *Caryota urens* and Fishtail Palms which were the native palm species. We saw spider burrows and learned about the feeding ecology of tarantulas and the way they build burrows lined with their saliva. There were a variety of lichens and mosses; yellow, black, and green. On reaching the grasslands, we spotted soil digging and suspected the presence of a Wild Boar. We were in the Shola grasslands, in the most beautiful ecosystem but unfortunately, the least researched ecosystem. It's visibly declining due to the introduction of acacias, etc. due to a lack of understanding of the importance of grasslands. It was filled with native grasses with patches of invasives. These grasslands were abundant with invertebrates, especially dragonflies. We saw a magnificent standalone earth orchid, white in colour amidst grasslands and *Bulbophyllum* sp. on barks of tall trees. We walked through the valley through the denser canopied part of the forest while heading back. All the stretches were so starkly different from each other highlighting the diversity. It was wondrous.

We ended our day with herping with S.R. Ganesh, we tried and spotted the frogs such as *Microhyla* sp., *Uperodon* sp., *Pseudophilautus amboli*, *Indosylvirana indica* and lizards such as rock forest lizard, geckos and snakes like Malabar Pit Viper, Wolf Snake, Brahminy Blind Snake and a shield-tail snake. Herping requires a different kind of vigilance and eye and the herping walk helped us build that.


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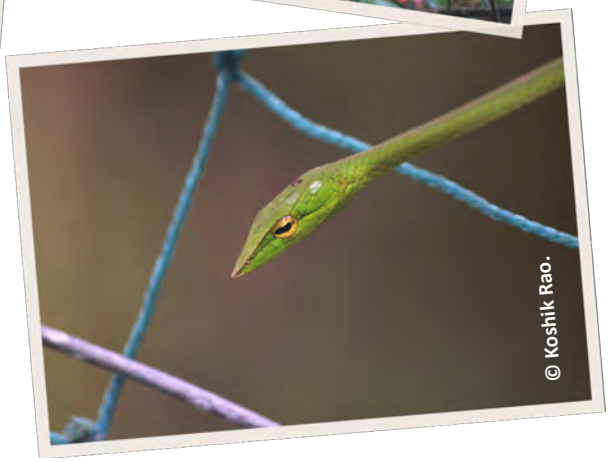
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DAY-3

Field Visit to the Dancing Frog Habitat and Dr. Vivek Pandi's Insights into Climbing Plants

On the third day of the RHATC field trip, we visited the Dancing Frog Habitat, a conservation initiative led by Mycelium. Located 6 km from our base, Dancing Frog offers an innovative model for preserving the delicate shola habitats of the Western Ghats. We were welcomed by Abhishek Jain, co-founder of Mycelium, who introduced us to the project's mission and methods.

Our first stop was at a stream called Hattihole, where Abhishek discussed issues with current flood control methods. He explained that stones used to reinforce riverbanks are often sourced from grassland rock habitats, a practice that disrupts these fragile ecosystems while offering limited flood control. Instead of containing river overflow, such methods risk intensifying downstream flow, endangering low-lying areas during periods of heavy rain.

We then ascended to a viewpoint with sweeping views of the surrounding hilltops, some of which are either already acquired by Mycelium or under consideration. These areas, adjacent to the Pushpagiri Tiger Reserve, represent a patchwork of private land Mycelium is securing for restoration and conservation. Abhishek shared Mycelium's approach to conservation, which involves purchasing and protecting private lands in the Western Ghats that are threatened by overuse. By removing these lands from the commercial market, Mycelium aims to restore and conserve their natural ecosystems. The 70-acre Dancing Frog Habitat, Mycelium's first major acquisition, is preserved with minimal human interference: 80% of the area remains untouched, while 20% is developed to support eco-friendly human interaction without compromising the ecosystem.

From this viewpoint, we also witnessed the evolutionary uniqueness and biodiversity of the Shola grasslands and the rocky outcrops. We saw balsam species thriving on natural outcrops. Several species of the herbaceous genus *Impatiens* are found on these plateaus.

Impatiens is a diverse genus, with over 1,000 species distributed primarily in the Old World tropics and subtropics (Dessai & Janarthanam 2011), with a few species also found in the temperate regions (Mabberley 2017). The genus is one of the most speciose angiosperm genus in India, with >220 species, and exhibits exceptional diversity and endemism in the Western Ghats mountains in southern India (Arigela et al. 2019) with more than 120 species (Bhaskar 2012), of which > 90% are endemic to these mountains, and new species continue to be reported at a high rate (Dessai & Janarthanam 2011; Narayanan et al. 2013; Hareesh & Sabu 2020; Vishnu et al. 2020). Thus, the Western Ghats are a hotspot of diversification of the genus. This diversity underscored the concept that "rocks shape life, and life shapes rocks" – a theme central to our discussions on biogeography and evolution.

After a refreshing lunch, we set out on a guided trek to a river stream within the Dancing Frog Habitat. Fellows enjoyed sightings of endemic species, including a dancing frog and four Malabar Pit Vipers, and many took the opportunity to swim in the stream's pristine waters—a highlight of the day.

Lianas and Climbers in the Forest: Returning to our accommodation at the Rainforest Retreat, we concluded the day with a talk by Dr. Vivek Pandi, who provided an in-depth discussion on lianas and their ecological role within tropical forest systems. Dr. Vivek Pandi, a plant ecologist and assistant professor of evolutionary biology at the Manipal Centre for Natural Sciences, has spent nearly 10 years researching the ecology and biodiversity of climbers in India. He holds a Ph.D. focused on woody climbers and is particularly interested in the evolution of climbing behaviour in plants. Dr. Vivek Pandi's contributions to the study of climbers, particularly in liana research, are remarkable and important. He has conducted an ecological mapping of lianas throughout peninsular India. His publication, 'Taxonomy and Ecology of Climbers – Climbing Plants of India,' presents his findings. Currently, his research centres on the taxonomy, systematics, and phylogenetics of Indian climbing plants.

Lianas significantly influence tropical forests by competing with trees for resources for both aboveground and belowground resources, which can hinder tree recruitment, growth, and survival (Pandi & Parthasarathy 2015). Lianas use five main climbing mechanisms to reach sunlight by attaching to host trees, as

they can't grow vertically on their own. These mechanisms include hooks, stem twining, tendrils, armed scramblers, and unarmed scramblers. In some tropical forests, lianas make up 32% of woody stems and 35% of woody species. They take advantage of high solar radiation, especially during dry seasons, often creating dense leaf cover that limits light for the host tree's photosynthesis. In the tropics, liana colonization on host trees is rising (Pandi et al. 2023), with common climber families including Cucurbitaceae, Menispermaceae, and Convolvulaceae. There are over 2,600 species of climbers across 196 families, notably with the genus *Piper* and family Fabaceae highly represented. On that day and the following day, we had the incredible opportunity for on-site learning about lianas. On 5 November we had a debate on lianas, where we were divided into two groups and given a common scenario involving lianas in a plantation. One group represented forest managers, while the other represented conservationists. The debate offered us a platform to recall and reflect on our understanding from Dr. Vivek Pandi's session.

The debate concluded with a discussion on how both teams could strengthen their points to create a more impactful argument.

Conclusion: Overall, the visit to the Dancing Frog Habitat gave the fellows an insight into the proactive and innovative approaches that can be taken for biodiversity conservation. Mycelium's efforts to preserve the unique landscape of the Western Ghats prove that biodiversity conservation initiatives can enter the mainstream economic market, with "conservation" being the goal. The entire day spent at Dancing Frog was finally complemented by Dr. Vivek Pandi's discussion on lianas, opened our minds to the uniqueness of these often undermined group of plants. This underscored the fact that each and every entity in an ecosystem is critically required to maintain an ecosystem's uniqueness, like that of the Western Ghats that the fellows got to witness first-hand.

DAY 4

Organic farming techniques & Rocky outcrops

Sujata took us around Valley 3 to introduce us to their farming practices. We spotted a gliding lizard, basking in the sun on a tree bark. This species is distributed in the entire Western Ghats and some parts of Eastern Ghats. It is an insectivorous lizard. We walked through the cultivated patches of avocados, cardamom and vanilla grown under the existing forest trees. They were grown in the valleys since they are well adapted to wetlands and pepper was cultivated on the slopes since it is adapted to well-drained soil. It was followed by a walk beneath the sprawling branches of *Garcinia cambogia*, with sunlight shimmering through its canopy, surrounded by the dense green and red foliage of *Garcinia indica* and the broad leaves of *Garcinia mangostana*. A Coffee Arabica tree stood nearby, almost unrecognizable due to its towering height. When left unpruned, coffee trees can grow so tall that harvesting becomes impossible, leaving the ripe fruits to fall from the treetops. They act as good mother plants, the big fruits do well for the coffee nursery and are savoured by Civets. One of the patches of the coffee plantations in the forest was left unpruned for Palm Civets to come to eat. Civets also eat the toddy palm's fruit and *Caryota urens*, a preferred food for Elephants (not

spotted here) and are native to hilly regions. The undergrowth was filled with invasives and discussion on invasive species followed.

Can invasives be helpful? Sometimes, yes, but, do not grow them. The characteristics of invasives like *Wedelia* sp. helped get back the soil cover which was washed away in the landslide, and now rock surfaces unsuitable for much growth remained. *Wedelia* sp. was eventually weeded out for four generations, shredded and used in manure. It was followed by the sowing of native grass seeds.

What are invasive species? Invasive species are organisms introduced by human activity that have not co-evolved with the local ecosystem. Their presence can disrupt local ecosystems, sometimes creating ecological imbalances that may cause native species to exhibit dominance-like behaviour, as seen with *Strobilanthes* spp. Undergrowth invasives such as *Hypoestes* sp., *Miconia crenata* which is native to Mexico and the Tropical America took over the ferns and grasses native to Coorg. *Miconia crenata* has colonized large patches of undergrowth in rainforests in southern Asia. This was introduced in Coorg only 15 years ago. In this colonization, native herbaceous weeds like *Commelina* sp. commonly called as Shankhapushpi and Mudleaf which is good in iron can be used as spinach and as nitrogen for livestock were replaced. What makes these herbaceous weeds aggressive is its runner system, roots radiate out and effectively take over.

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Lantana camara, another invasive species has been adopted by butterflies, why? Butterflies are attracted to a certain ultraviolet reflections

and Lantana generates the same. It is not because of the chemical it releases that attract the butterflies. So, Butterflies haven't evolved with the *Lantana camara*. It is found to be a good food plant but not a host plant that may eventually lead to declining butterfly populations.

Spathodea campanulata or the African Tulip Tree, another rampant invasive tree species was found amidst evergreen forest. It attracts a lot of parakeets, birds, and fireflies.

On our walk further, we saw Wild Pepper which has been observed to be very resistant so it's been there undisturbed followed by a *Salix tetrosperma* bark which was used for aspen production during Aristotle times and is a native species. We saw a humongous *Magnolia champaca* with a narrow umbelliform crown.

Then we were introduced to an alternative way of thinking of pests. They developed a strategy of using repellants rather than killing the pests or insects. They set out to try different combinations of plant extracts and chose the one that worked well. They used it to repel stem borers on coffee and cardamom plantations and then kill them. It was to say to the borers, "Hey, don't feed on this, feed on something else". These are the kind of holistic solutions that systematic, scientific thinking leads to.
We were guided to the rockier parts of the mountains by Purvy, Abhishek's sister who is into urban landscaping and spotted a lot of annual grasses such as *Canscora heteroclita*, mosses, lichens and the *Riccia* bryophytes which is more primitive than mosses. These form the skin of the forest. These have evolved along with this rocky ecosystem. The exposure of the ecosystem to the sun led to growth of small perennial grasses that die with monsoon, but the root still remains and the cycle repeats.

Strobilanthes found in this rocky region were very small in size compared to the ones growing in the undergrowth of forests. This size reduction is an adaptation to this ecosystem.

How do we figure out if the grassland is undisturbed and healthy? The presence of narrow endemics would act as a very good indicator. This particular site was grassland 20 years ago (Sanjay Molur pers. comm.) and now the area of grassland has been reduced due to Acacia and other tree plantations.

We were greeted with beautiful orchids in the grasslands such as *Dendrobium* sp. and *Cleistoma* sp. and tiny mushrooms on our way back.

DAY-5

Composting

At Rainforest retreat, we had the opportunity to learn about compositing from Sujata who herself is involved in this interesting process.

Ingredients they used were cow dung and cow urine which help in the decomposition process and the leftover fodder provides carbon material essential for balancing the compost. A natural microbe supplement is prepared with a mixture of jaggery, peanuts, and daal, spray it and cover it with a tarpaulin and leave it for 6–7 months. For big plants, two tubs and for small plants one tub of mixture is spread around them. These contain beneficial microbes that accelerate

the decomposition of organic matter. Once the compost is ready, it will have a dark, crumbly texture and an earthy smell. This compost improves soil fertility and promotes healthy plant growth.

Biogas Production Process: They rear cows which makes it easier for them to get cow dung as in the biogas process, a large amount of cow dung is required initially. There was a sealed container where the anaerobic digestion (breakdown without oxygen) occurs so they put a large quantity of cow dung in that container. Then add any bio-waste such as kitchen waste (vegetable peels) and finally use it for cooking gas. Later we also had the opportunity to get involved in shifting and applying organic compost to the plantation, enhancing our practical understanding of sustainable practices.

DAY-6

Herpetology at Hunsur: Exploring the World of Snakes and Conservation

On the sixth day, we arrived at Gerry Martin's facility in Hunsur around midday. This visit to Hunsur offered an introduction to herpetology and conservation with various sessions on different aspects of the world of snakes.

Behind the Scenes at the Liana Trust: Conservation and Care for Captive Snakes

Following lunch and a brief introductory session, we were given a tour of the serpentarium, where various snake species – both native and non-native – are housed. The non-native snakes had primarily been rescued from the illegal pet trade. Lisa, who is the curator, guided us through the serpentarium and provided an in-depth explanation of how the snakes were brought to the facility, why they cannot be released back into the wild, and the methods used to care for them in captivity.

The enclosures are designed to replicate natural conditions, including provisions for food, UV light, and Infrared A, B, and C to simulate natural light sources. Among the species housed in the serpentarium were the Hump-nosed Pit Viper *Hypnale hypnale*, Russell's Viper *Daboia russelii*, Common Krait *Bungarus caeruleus*, Malabar Pit Viper *Craspedocephalus malabaricus*, King Cobra *Ophiophagus* sp., Saw-Scaled Viper *Echis carinatus*, and Spectacled Cobra *Naja naja*, along with a few non-native species.

Lisa explained the naming protocol used in the serpentarium, which combines the first two letters of the genus and species names, the state abbreviation where the snake was found, and an individual identifier number. She also showed us a new enclosure under construction for the spectacled cobras and kraits, designed to provide larger spaces to house snakes in pairs.

We were introduced to the use of passive integrated transponder (PIT) tags, small subcutaneous microchips implanted in snakes for identification in enclosures with multiple


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individuals. These tags can be scanned with a handheld biometric reader for close-range identification. Gerry demonstrated this process by implanting a PIT tag in a recently rescued Russell's Viper. The serpentarium plays a crucial role in venom collection for antivenom production, which they provide free of charge. They have also developed an app called 'Ophion', which catalogues detailed information about each snake in their care.

In addition to the serpentarium, we toured the farm, which houses a variety of exotic animals rescued from the pet trade. Lisa highlighted that the farm undergoes regular inspections by the forest department to ensure compliance with regulations.

Exploring the Evolution of Venoms with Dr. Timothy Jackson: In the evening, we attended a session with Dr. Timothy Jackson, an evolutionary toxinologist from the Australian Venom Research Unit (AVRU) at the University of Melbourne, Australia. The session walked us through the evolutionary dynamics of venom, its ecological roles, and practical applications. Dr. Jackson began by saying that biology is fundamentally the study of relationships, broadly categorized into ecology and evolution based on their scale over time and space, which are deeply interconnected. He clarified the distinction between a toxinologist and a toxicologist, explaining that while toxicologists study the harmful effects of toxins, toxinologists focus on the biology of toxins, examining how organisms produce and use them as part of their life strategies.


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Discussing the evolutionary history of toxins, Dr. Jackson introduced the concept of organisms "using or stealing" molecules produced by others to serve their own purposes, likening this to human tool use. He cited examples such as:

- Keelback snakes that are resistant to toad toxins, and genera like *Rhabdophis* and *Macropisthodon* that "steal" toxins from their prey, sequestering them in specialized glands for future defence.
- Larvae of certain insects, which feed on toxic plants, store these compounds to make their adult forms, such as butterflies, unpalatable to predators.
- Kleptocnidy, which is a fascinating phenomenon where predators consume cnidarian prey and sequester their cnidocytes (stinging cells) in their tissues, enabling them to sting their prey. Predators can replenish these cells every time they feed, effectively borrowing a molecular defence mechanism.
- Dr. Jackson highlighted that this form of "molecular tool use" is widespread in nature, illustrating the remarkable adaptability and ingenuity of life.

He also discussed the three fundamental principles of evolution: variation, heritability, and selection, with a focus on venom systems.

He explained that venoms exhibit significant variability, even among individuals of the same species. This variability contributes to the challenge of using antivenoms across different regions, as a formulation effective in one area may not work elsewhere. He also highlighted the diversity in the development of defence and venom systems among snakes, observable even today. This ranges from species with undifferentiated dentition and non-venomous dental glands, like rat snakes, to highly specialized adaptations such as:

- Pythons: Constrictors that rely on mucous secretions from dental glands to assist in swallowing prey.
- Front-Fanged Snakes: Families like Elapidae, Viperidae, and Lamprophiidae, which possess advanced venom delivery systems.
- Rear-Fanged Snakes: Found in the Colubridae family, which have less specialized venom systems.

He also discussed how feeding ecology influences venom variation among closely related species. An intriguing aspect he highlighted was the ontogenetic shifts in viper venom composition, where the venom of juvenile vipers differs from that of adults. This variation is believed to be linked to differences in feeding habits and the physiological characteristics of their prey at different life stages.

He ended by talking about the evolutionary arms race, which is a situation where predator and prey species develop adaptations in response to each other over time. For instance, the garter snake has evolved resistance to the newt's toxin, while the newt has become more poisonous. In areas where the two species live together, the levels of toxin and resistance are higher. When separated, the levels are lower.

Bringing Conservation & Research to the Classroom with Chandini: The session, led by Chandini, a nature educator from the Liana Trust, focused on integrating conservation and research into educational activities. She emphasized the importance of taking learning beyond the confines of traditional classrooms and engaging children with hands-on, creative activities to teach them about conservation and the natural world.

Chandini shared several examples of how to make learning interactive and fun:

- The Fossil Game: An activity to teach children about dinosaurs and fossil studies.
- “Eat Food Using Beaks” Game: Demonstrates the diversity of bird beaks and how their shapes help birds eat or catch prey.
- The Biscuit Moon Game: A playful way to illustrate the moon's phases using biscuits to explain the changes.

She stressed that such activities should be simple, imaginative, cost-effective, and adaptable using readily available materials.

Chandini also suggested using relatable objects to help children understand the size and scale of animals.

Recognizing that children may retain only some of the information shared, she recommended focusing on physical, interactive activities rather than lengthy explanations or lectures. Examples included:

- Bioenzymes and Biomimicry Activities: To highlight the importance of reducing, reusing, recycling, and waste segregation.
- Plastic Ingestion Demonstrations: To raise awareness about environmental issues like plastic pollution.

Chandini also advocated for organizing workshops for teachers, equipping them with the skills to conduct these activities in their schools. She underscored the goal of bridging the gap between knowledge and action through engaging, enjoyable learning experiences that inspire children to connect with nature and adopt sustainable practices.

We ended the day with a herpetology walk around the farm, guided by Gerry and Dr. Tim. Despite the insightful discussions and explorations, the walk did not result in any snake sightings.

Understanding Snakes and Snakebite Prevention in India: Insights from Gerry Martin: The following morning, Gerry Martin conducted a session titled "Snakes and Snakebite in India," where he introduced the basic characteristics of snakes. He explained that snakes are reptiles with forked tongues, limbless bodies, water-tight scaly skin, and no eyelids. They use their


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forked tongues to sense their environment, transferring chemical signals to the vomeronasal organ, also known as Jacobson's organ.

Gerry discussed India's rich snake diversity, currently comprising approximately 342 species, of which around 60 are venomous to humans. However, only 17–20 species are considered medically significant. He also noted the presence of "weed species" that are commonly found near human habitats. Further, he also explained how anti-venom is prepared.

The session then focused on human-snake conflicts, with Gerry emphasizing prevention and appropriate care in conflict situations. He redefined the concept of "snake rescue", explaining that it often serves to rescue humans rather than snakes, and when done recklessly for showmanship, it can endanger both the rescuer and the snake. He highlighted that relocating snakes is not a viable solution, as snakes struggle to survive in unfamiliar environments, often leading to their death. One of the critical issues Gerry addressed was the lack of understanding about coexisting with snakes. He pointed out that in snakebite

situations, poor knowledge of first aid and treatment, coupled with widespread superstitions, often exacerbates the problem. He also debunked several myths and legends surrounding snakes and the exaggerated tales about them. Gerry stressed the importance of learning to coexist with snakes, offering practical pointers on avoiding snakebites and mitigating conflicts. His session underscored the need for education and awareness to foster coexistence and minimize human-snake encounters.

Conclusion: The experience in Hunsur provided valuable insights into the importance of conservation, education, and a deep understanding of snake behaviour and venom for effective management and coexistence. The knowledge gained from these sessions will serve as a foundation for future efforts in conservation education and practical action, fostering a more informed and responsible approach to wildlife management and environmental sustainability.

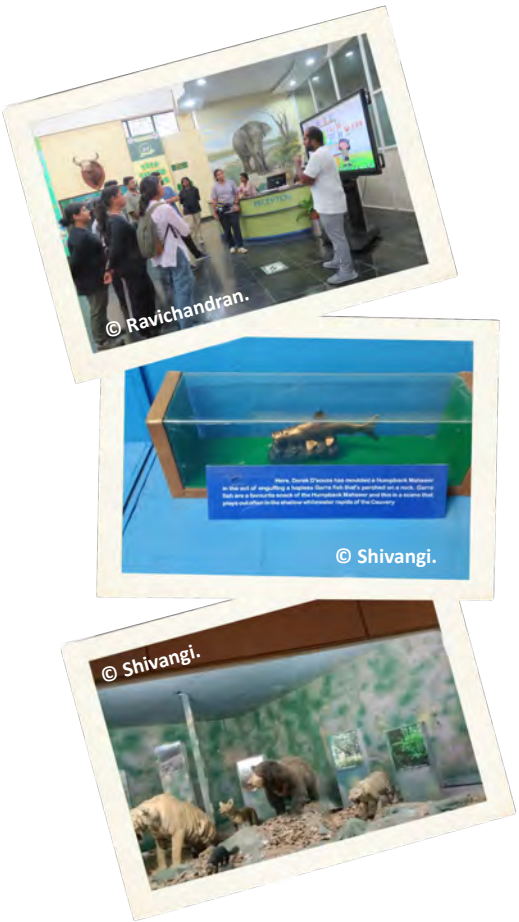
DAY 7–8

Exploring the Natural History of Mysore: Peeping into the Regional Museum of Natural History and the Zoo

Despite feeling a bit worn out from our full day at Gerry Martin's place, our group set off early on the seventh day after a brief yet insightful lecture by Gerry himself. The two-hour journey to Mysore was a peaceful one, with most of us catching up on rest. Arriving with a lighter schedule ahead, we looked forward to a more relaxed day, with visits planned to the Natural History Museum and Mysore Zoo.

The museum promised to connect the evolutionary concepts we'd explored in Sanjay's lectures, offering a concrete perspective on the history of life. The zoo, a cornerstone of conservation in society, would help us understand the critical role of captive wildlife management and its importance in fostering public awareness and protection of biodiversity.

By the afternoon, we arrived in Mysore and met Thanuja, a naturalist who joined us for a fruitful discussion over lunch. Following this, she led us to the Regional Natural History Museum, one of India's oldest natural history museums, inaugurated in 1985, which showcases the biodiversity of southern India, particularly the Western Ghats. The museum curator gave us a brief introduction to its origin and establishment before guiding us through its three main galleries: Temporary, Biodiversity, and Discovery. The Temporary Gallery highlights a single species or conservation issue, aiming to raise public awareness about endangered species.



During our visit, the focus was on the Mahseer fish, an endangered freshwater species crucial to the Cauvery River ecosystem. The exhibit depicted the fish's history, from its significance during colonial hunting periods to its unique habitat requirements and the growing threats it faces. It was eye-opening—and alarming—to learn that recent surveys found only about 12 individuals along an extensive stretch of the Cauvery. This gallery offered a comprehensive view of the Mahseer's role as an apex predator in freshwater ecosystems, underscoring its importance to conservation.

We then moved to the Biodiversity Gallery, with a primary focus on the Western Ghats. Here, the evolutionary timeline was illustrated through fossils and images, highlighting major events in Earth's history. Having some background on evolution from previous lectures, we could appreciate the display's flow. However, it left us wondering: how many museum or zoo visitors would have this foundational understanding?

The experience underscored the need for conservation education, as these displays could inspire curiosity about evolutionary history among the broader public. Additionally, the gallery's taxidermy displays, featuring charismatic species like the tiger and lion alongside lesser-known taxa, emphasized the unique ecological roles of each species.

The gallery also displayed Western Ghats Forest types, with maps illustrating their distribution and associated species. The final section focused on the indigenous communities of the Western Ghats, emphasizing their deep connection to the land and wildlife. This inclusion reinforced the importance of integrating local communities into conservation efforts and highlighted that human, too, are part of the natural world. Conservation, after all, becomes feasible only when humans see themselves as part of nature.

Lastly, we explored the Discovery Gallery, designed to spark curiosity in children. A full whale skeleton—even awe-inspiring for adults—dominated the space. Additional displays included specimens and fossils illustrating past discoveries and current conservation challenges, such as climate change, pollution, and plastic waste. These exhibits aimed to inspire even young visitors to think critically about environmental issues.

In summary, even a short visit to the museum stirred many questions and thoughts. For some visitors, particularly children, this experience might just plant the seeds of curiosity. If even one child leaves with a question in mind, that, in itself, would be a small but meaningful step toward change.

After the museum, we went to the hilltop of Chamundi, where the deity of Chamundeswari and the demon Mahishasura stood their place pointing to the cultural heritage and history of Mysore. However, we were surprised to hear the story of Mahishasura after whom the city is named, who was the deity of the tribal community and was portrayed as a demon and killed by a rival deity. That was an unheard story of Chamundi hills, though a bit annoying to at least some of us, it made sense as a whole.

To our surprise and delight, we had the chance to meet Dr. Mewa Singh, a renowned primatologist who has completed an impressive 50 years of primate research. Much of his work has focused on the Lion-Tailed Macaque and the Bonnet Macaque, and he shared valuable insights into conservation strategies specifically aimed at these species. His talk provided a window into how decades of dedicated research have shaped his understanding and recommendations for their conservation.

Our group was eager to learn more about his journey, particularly regarding the role of community perception in conservation efforts. While he acknowledged the importance of social factors, he noted that community-focused aspects were not his primary area of interest, leaving that side of conservation to those in the anthropological field. Nevertheless, his emphasis on scientific data as a foundation for conservation was powerful. For instance, it was surprising to learn that, despite the Lion-Tailed Macaque's endangered status, its populations are relatively stable compared to those of the Bonnet Macaque, which was previously classified as 'Least Concern.' In fact, due to Dr. Singh's findings, the Bonnet Macaque's status has been reassessed to 'Vulnerable' by the IUCN—a testament to the impact of his research.

By the end of our discussion, we came away with a deeper understanding of the importance of long-term monitoring and consistent studies

of species distributions. Conservation cannot proceed effectively without a foundation of solid, continuous scientific data—a principle clearly demonstrated by Dr. Singh's remarkable career.

Our last day began at the historic Mysore Zoo, accompanied by Thanuja, who enriched our visit with stories of the zoo's evolution and the journeys of its animals. This was no ordinary zoo visit—our curiosity was focused not on the animals themselves but on the zoo's history and its role in conservation. At every enclosure, Thanuja shared stories of the zoo's transformation over time, providing context that deepened our understanding. A highlight was learning about the native neem tree, *Melia azedarach*, and the surprising fact that the commonly known *Azadirachta indica*, or Indian neem, is actually not native to much of India.

Sanjay further added to our insights with the story of Sally Walker, founder of Zoo Outreach Organisation. Despite having no scientific background, Sally's commitment to conservation was sparked at Mysore Zoo, which ultimately shaped her career in wildlife conservation. Her journey underscores the unique power of zoos to inspire change and action even beyond traditional academic paths.

The visit to Mysore Zoo was timely, as the role of zoos in conservation is increasingly debated. Zoos have long been vital for education, research, captive management, and maintaining gene banks. Yet, as we walked through the zoo, we couldn't help but question whether modern zoos still meet these high standards or whether they are being driven more by economic

motives than conservation. Many questions, both answered and unanswered, lingered as we made our way back to Coimbatore.

Ultimately, this experience forced us to confront some hard truths about conservation—there are some questions that, at least for now, have no clear answers. And perhaps that's the nature of conservation work: complex, ongoing, and filled with challenges that require both patience and perseverance.

Acknowledgement

We, the fellows of the RHATC batch 2024–25, want to express our heartfelt gratitude to everyone who made our learning experience enriching and memorable.

We thank Abhishek Jain for introducing us to the Dancing Frog, an innovative model for preserving the Western Ghats' delicate Shola habitats, and Dr. Vivek Pandi for introducing us to the fascinating world of lianas, which has expanded our understanding of climber ecology.

We are grateful to Miss Thanuja for her time and knowledge, which provided us with insights into the

Regional Museum of Natural History and the zoo. We also thank the museum curator for guiding us through our visit. We are grateful to Dr. Mewa Singh and his team for hosting us on the Mysore University campus, and we especially appreciate Dr. Mewa's engaging talk about his 50-year research on primates.

We are grateful to Gerry Martin for hosting us at Hunsur and introducing us to the fascinating world of snakes. His extensive knowledge of snake behaviour and the difficulties of human-snake interaction was truly enlightening. Our thanks also go to Dr. Timothy Jackson for his fascinating presentation on snake venom, its evolutionary history, and ecological significance. His ability to link complex scientific concepts to larger ecological themes was captivating.

We appreciate Chandini Chhabra's engaging and creative session on conservation education. Her innovative approaches to incorporating conservation into the classroom, as well as her emphasis on hands-on activities, were both educational and inspiring. We also thank Lisa Gonsalves for her in-depth insights into captive snake care and conservation. Her dedication to providing a safe environment for rescued snakes and her concern for their well-being deeply inspired us.

A special thanks to Shivaani A., assistant curator at the Liana Trust, for taking the time to show us around the rescued animals, share her experiences, and explain how RHATC helped her in her conservation journey. Finally, we want to thank the entire team at The Liana Trust, Hunsur, for their hospitality and for creating an environment that promotes learning and collaboration.

Each session has expanded our understanding of herpetology, conservation, and education, and we are grateful to each speaker and host for their time and effort in sharing their knowledge with us.

Finally, we express our heartfelt gratitude to Dr. Sanjay Molur for providing us with this incredible opportunity to explore, and to the Zoo Outreach Organisation for making this trip possible and memorable.

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

Tales from Himalaya: The Chamba Conservation Story

"The beautiful valley, Chamba in Himachal Pradesh harbors rich wildlife including an endangered species of langur that sparked my journey in conservation". That's how Vishal Ahuja, project co-ordinator of the Himalayan Langur Project (HLP) from Zoo Outreach Organisation, talked his way into conservation in 'Follow the Leader' session as part of the Ram Hattikudur Advanced Training in Conservation (RHATC) Program, 2024–25.

The session began with an overview of the project's first phase, which aimed to gather baseline data on the distribution of the Chamba Sacred Langur. These langurs inhabit multi-male, multi-female groups ranging from 25–40 individuals. The adult males possess a mane-like, grayish-brown upper coat and females or young ones may not have the coat, yet they are equally beautiful and attractive. They are classified as 'Endangered' by the IUCN Red List because of their limited range and low population. Moreover, prevailing conflicts with humans also demanded the first phase to include conflict zone mapping and documenting conservation challenges in Chamba. To resolve long standing taxonomic uncertainties, Vishal, Sanjay and the team distinguished between two species—*Semnopithecus ajax* and *Semnopithecus hector*—based on morphological traits. *Semnopithecus ajax* was found in 124 out of 244 sites in Chamba, out of which 76 reported interactions between humans and langurs. The Himalayan Langur Project collaborates closely with the communities in Chamba to create cooperative conservation via

CSL feeding from a garbage dump. © Arpan.

HRP HLP Team ©Paridhi.

Chamba, Himachal Pradesh- Himalayan Restoration Project has been working here since 2021, to restore the degraded forest and livelihoods. © Sanjay Molur.

education and research. This finding prompts an important question: Why do wild animals risk their lives to venture into human-inhabited areas when they have ample food available in their natural habitats? This set the stage for the project's second phase (2014–2016), which seeks to explore the underlying factors driving such behavior and develop strategies to mitigate these interactions. Perception studies were then initiated by Vishal and his colleagues, who noted that men commute outside the hamlet to earn their daily income, while women work mostly on fields. They surveyed 51 villages and discovered that maize (100%) is the most important crop, followed by barley (43%) by langur destruction. In an effort to reduce conflict between people and animals, phase three (2017–2019) started with outreach initiatives, such as workshops to identify plant species in the Khajjiar-Kalatop Wildlife Sanctuary.

The Himalayan Langur Project has paved its way into the development of Himalayan Restoration Project (HRP), as much of the foundational work was already completed in the HLP. The project is ongoing, primarily driven by researchers who are not only studying the species but also focusing on the perspective of human-animal coexistence issues. In July 2020, 110 trees were planted on a farm close to Gajnui, utilizing natural species that provide as food for langurs, macaques, and bears. Himalayan chestnut and walnut were planted in Mayari Gala, Baddi, and Chapnaal in the winter, with

Education outreach program at the government school. © Sanjay Molur.

HRP Team setting up the nursery. © Sanjay Molur.

additional pre-monsoon planting taking place in June 2021. Vishal addressed the Zoo Outreach Organisation's awareness-raising initiatives in collaboration with village heads, forest officials, and women's self-help groups (WSHGs) in Chamba. Pre-monsoon plantings resumed in 2022, with the WSHGs in Chattar village planting 120 saplings, Rathiyar village planting 350, and Dugli village planting 300. With the objective to further promote long-term conservation, this awareness effort resulted in an agreement with Shakti from Dugli village to build a wild fruit nursery.

The study revealed that a lack of native plants in the forest is driving langurs to invade farmland, damaging crops. As a result, seed collection initiates in November 2022 and the Astral Foundation provided funding for the construction of a nursery in March 2023. The team started growing indigenous plants, such as *Prunus cerasoides*, *Pyrus pashia*, *Grewia optiva*, soapnut, horse-chestnut, and walnut. In 2023, nursery activities expanded, and Kritika began her internship program conducting a census study along six trails in collaboration with the Himachal Pradesh Forest Department (HPFD), and she emphasized that traffic congestion and langur feeding are increasing human-langur conflicts in this mountainous area. The outreach program continued to expand, reaching schools and colleges to raise awareness among not only students but also to women in WSHGs. Green Hub documented this capturing its progress and impact.

The HRP initiative has impacted 28 villages, engaging 500 families, and 2,000 people. They have established 400+ herbarium sheets of the native plant species found in the region.

Sanjay and Trisa at the nursery. © Kritika.

The HRP team interacting with the women to understand the problems they face at Jhille Nalli. © Sanjay Molur.

WSHG working towards restoration. © Vishal Ahuja.

As part of the initiative, they have created ecologically-focused community empowerment and community-driven restoration activities, engaging two local representatives to promote sustainable livelihoods. More than 400 individuals, in collaboration with Zoo Outreach Organisation, are actively engaged in planting 1500 native saplings alongside germinating 3,000 seeds of endangered plant species. Simultaneously, the team has trained over 50 HPFD personnel to monitor wildlife effectively, working together with local communities to identify and safeguard wildlife corridors across 28 villages, thereby protecting critical habitats and enhancing ecosystem restoration.

During the session Amrin, an intern, provided observations about the species recorded on camera traps in Chamba. The recordings featured Asiatic Black Bear, Chamba Sacred Langur, Rhesus Macaque, Grey Mongoose, Yellow-throated Marten, Jungle Cat, Leopard Cat, Red Fox, Indian Crested Porcupine, and local inhabitants also contributed to the documentation, as a few unintentionally trapped the pictures in the cameras while checking the traps.

The major takeaway from the session was the power of community-driven conservation, revealing how collaborative efforts can bridge human-wildlife harmony and preserve biodiversity for generations. In addition to that, it is also crucial to recognize challenges and have an open mindset, and communication skills for long term conservation strategies. Thinking about the session, a quote surfaced from Mysore Zoo: "Wild animals are great assets". With this motivation, I'd like to express my appreciation to the whole team and Zoo Outreach Organisation for organizing this fantastic session. Also, I'd like to acknowledge my fellow batchmates for their support.

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

The entrance of the campus with trees on both sides. © Mohsin Bhat.

Conservation in Action:

Exploring Kumaraguru's Green Initiatives

One of the RHATC fellows interacting with the volunteers. © Arunkumar.

The initial disappointment of hearing that Dr. Rajeev couldn't join us for the session due to unforeseen circumstances was soon replaced by excitement as we were told that we would have a field visit instead. Kumaraguru Group of Institutions was already familiar to us from a previous visit, but this time was different—it was a biodiversity trail, something truly special. The first look at the campus, with its lush greenery, immediately sparked thoughts about the variety of life it might host. Could there be more biodiversity hidden within this vibrant space? These thoughts flashed through our minds as we prepared for the adventure ahead. Setting aside our initial excitement, we entered the campus with open minds, eager to explore and absorb new knowledge.

Exploring the Ahimsavanam. © Koshik V Rao.

Our visit was hosted by Miss Pranavi, a third-year graduate student, and Mr. Paramaguru, a staff member, both actively involved in the campus

Observing the nursery of native plant propagation © Koshik V Rao.

biodiversity initiative. They guided us through the 250-acre campus, showcasing various efforts and facilities aimed at promoting sustainability and biodiversity conservation. We began at the Ahimsavanam, a one-acre natural forest created in the campus. Following this, we explored their solid waste management system, where Mr. Netaji, the biodiversity initiative coordinator, joined us and explained their processes. The campus generates about a ton of solid waste and processes 5 lakh liters of sewage water daily, reflecting the scale of operations required to support its population of 12,000 people.

Next, we visited their solar power field, followed by the liquid waste management system, where treated water is purified for reuse.

Solar panels on the roof. © Mohsin Bhat.

One of the most notable stops was their nursery, which aims to raise 1.5 lakh saplings of native tree varieties to be planted both on and off-campus. They also employ a technique of hardening plants through gardening to ensure sapling survival in resource-scarce environments.

Our final stops included the campus's rainwater harvesting system and their cattle collection,

followed by a visit to the Insect Museum at Tamil Nadu Agriculture University.

Among the various initiatives we explored, Ahimsavanam stood out as a significant effort towards ecological restoration, a topic of critical importance in today's conservation debates. The rationale behind naming it "Ahimsavanam" might stem from paying respect to the Father of the Nation, but its direct connection to conservation remains unclear. Nevertheless, the name is secondary to the intention, which is commendable and deserves appreciation.

The initiative of creating and maintaining a small forest within the campus is highly promotable and holds immense potential. Beyond its symbolic value, the forest offers tangible benefits. The microclimate within the forest was strikingly cooler compared to the surrounding areas, a fact that students confirmed, particularly during the summer months. This highlights the immediate environmental benefits of such ventures.

Instead of relying on artificial barriers like concrete walls, the forest is protected through bio-fencing. Ten plant species have been strategically planted around the boundary, forming a natural barrier


The sewage treatment plant. © Mohsin Bhat.

that is already taking shape. This approach not only preserves the natural aesthetic but also supports the overall biodiversity of the space.

Considering the contemporary relevance of restoration efforts, I would personally regard this venture as one of the most impactful steps taken by the campus authorities. Ahimsavanam serves as a model for integrating conservation and sustainability into institutional spaces, offering inspiration for similar initiatives elsewhere.


At the solid waste management plant. © Shivangi.

The visit to Kumaraguru Group of Institutions provided valuable insights into their efforts toward conservation and sustainability. Among these, Ahimsavanam stands out as a remarkable initiative, highlighting the importance of restoration in the present scenario. By creating

a natural forest within their campus, they have not only fostered biodiversity but also demonstrated the environmental benefits of native plants and sustainable practices. Their innovative approach to resource management—recycling waste from the kitchen to cattle, from cattle to compost, and then back to plants—sets an example for maintaining resources in a sustainable cycle.

However, certain drawbacks need to be addressed to enhance the effectiveness of their efforts. The seeds and saplings for the nursery are being collected from across Tamil Nadu, which could introduce issues of regional invasiveness, as plant species native to one region may become invasive in another. Additionally, Ahimsavanam itself has been infiltrated by a few invasive species, which could threaten the delicate balance of its ecosystem.

Another concern is the propagation of a particular Jamun species, whose seeds are being collected from a single tree planted by the Father of the Nation during his visit to Tamil Nadu. While preserving such trees for their historical importance is commendable, using seeds from one tree for large-scale planting could reduce genetic diversity and increase the risk of inbreeding depression.

Despite these challenges, the institution's focus on restoration, biodiversity, and sustainability is inspiring. Their efforts serve as a model for integrating conservation into educational spaces, and with minor adjustments to address these drawbacks, their initiatives could achieve even greater ecological and scientific significance.

Mohsin Ahmad & Sidharthan, RHATC Fellows 2024–25, Zoo Outreach Organisation, Coimbatore, Tamil Nadu, India.

RHATC fellows with volunteers of the biodiversity initiative. © Arunkumar.

Nature's Storytellers: The role of tour guides in Conservation

"We firmly believe that nature guiding isn't just about showcasing landscapes; it's about repairing our connection to the Earth" says Payal Mehta, one of the team leaders of Nature Guides Academy in our very first session 'Career as a nature guide' of 'Follow the Leader' as part of the Ram Hattikudur Advanced Training in Conservation (RHATC) Program, 2024–25. I want to thank Zoo Outreach Organisation for organizing this session and Payal for being a wonderful speaker; her presentation was informative, entertaining and last but not the least my fellow batchmates who helped me write this article.

Nature guide or naturalist or experts as they use these words for individuals who interpret nature for people who visit forest areas. Since ecotourism was introduced in India, in the past decades there has been a sudden hike in tourism. Social media has contributed towards increasing the hype for eco-tourism. Being a nature guide is a newly known profession today. Being born and raised in Mumbai, Payal completed her master's in mountaineering course and then entered in MNC. But all this time somewhere inside, she knew that she was missing something and when she heard about the naturalist training program in her social circle happening in Taj Safaris, she jumped in to the opportunity with the support from her family. The course was to train individuals as nature interpreter in their upcoming resorts at central parts of India. After that, she never looked back. She always had curiosity about this field and once started, she knew that this was her calling.

Being a nature educator, I resonated with her primarily on the point where she mentioned people think that it's a very fun job to be in a forest and get paid for it. While it is exciting to be in wilderness, but it was not like you will expect something and you will get it for sure. There is always the fear of facing the unknown and the different expectations of the group that one has to take care of. Sometimes the disappointment of not sighting an animal. And lastly, the struggle in managing family time. A nature guide needs to do some preparations beforehand. Of course it is worth the hustle to understand these challenges, we face during interacting with our

respective audiences. It is also very common in the field of conservation to look down upon the nature guides as if the profession has nothing to contribute towards the ultimate goal of conservation. This talk was a step towards breaking this myth and to dive deeper into 'Nature Guiding' as a profession and how it can have a direct impact on conservation.

Payal briefly shared about the role of naturalists, meaning of tourism, fun and challenges about it. She discussed the net impact of tourism on wildlife and the community associated with it. Naturalists play a connecting point between people and nature. They are trained observers of the wildlife who gives you information about the importance of biodiversity and how it affects our day-to-day life. In the present scenario, apart from considering nature guiding as a profession, we need self-motivated enthusiastic individuals to take conservation to the next level.

At the end of the session, Payal discussed issues like how we can try to encourage controlled tourism and exploitation of the resources by drawing the line between greed and sensible tourism. Batting should be banned, instead of that work with communities who are sharing spaces with the wild. This would encourage them to do conservation. We can recommend some strong policies regarding the resources used by economically driven people so that resources don't get exploited. It is the local communities who suffer because of this unchecked tourism. Her take on night safari and bird watch from hide was not fully acceptable when we think from a wildlife point of view if that protected area has a water scarcity, then we could setup artificial waterbody to enrich the wild animals but, it cannot be tolerated in any case that the water scarcity economically exploited. Apart from these, she also brought the current issue of Dibang valley dam to our notice.

After this session according to my understanding, in India, eco-tourism started with the hope of connecting people with nature, providing livelihood to the local communities along with conservation but it has taken a turn from the initial goal of conservation to mere economic benefits. I wants to become a conservationist so that I can do my bit to make people understand the value of nature and natural resources. I hopes this discussion would encourage you to be driven more towards conservation through responsible tourism.

Gupta Priya, RHATC Fellow 2024–25, Zoo Outreach Organisation, Coimbatore, Tamil Nadu, India.

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21 December 2024

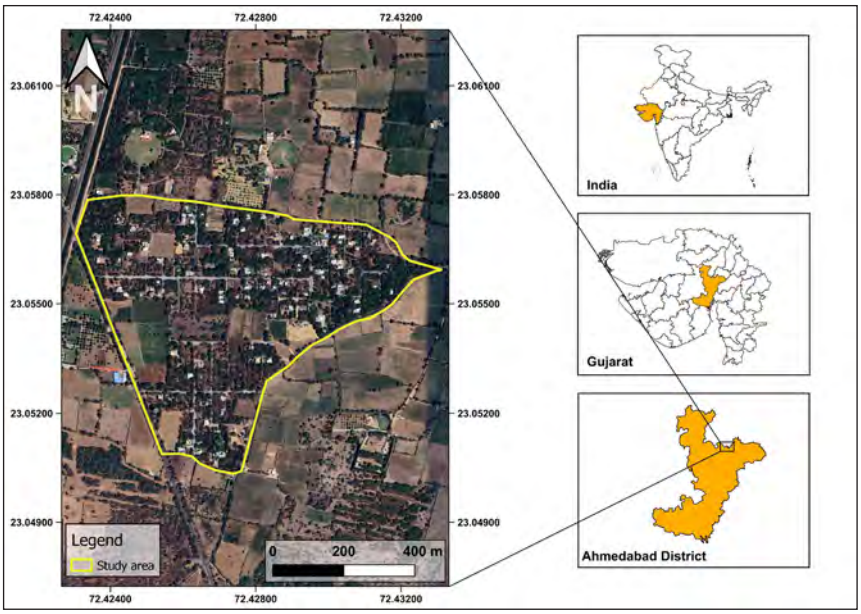
Ophidian diversity and distribution in a peri-urban area of western Ahmedabad, Gujarat, India

Green spaces and biodiversity in urban and peri-urban settings are known to show positive effects on human health and well-being through their ecosystem services (Aerts et al. 2018). However, the reptilian diversity in such landscapes does not always gain the desired attention (Brum et al. 2023), and their ecological roles are often undermined (de Miranda 2017). Ophidians (snakes) have fascinated people since time immemorial and hold significant cultural values. Globally, studies on snakes in urban settings have focused on understanding their diversity, anthropogenic impacts, and human-snake conflict (Brum et al. 2023). In India, some snakes are termed "medically important", and given the religious and cultural ethos, understanding their diversity and distribution is key to sustaining these values that promote coexistence of all life forms. The state of Gujarat holds a valuable diversity of reptilian fauna (Vyas 2007).

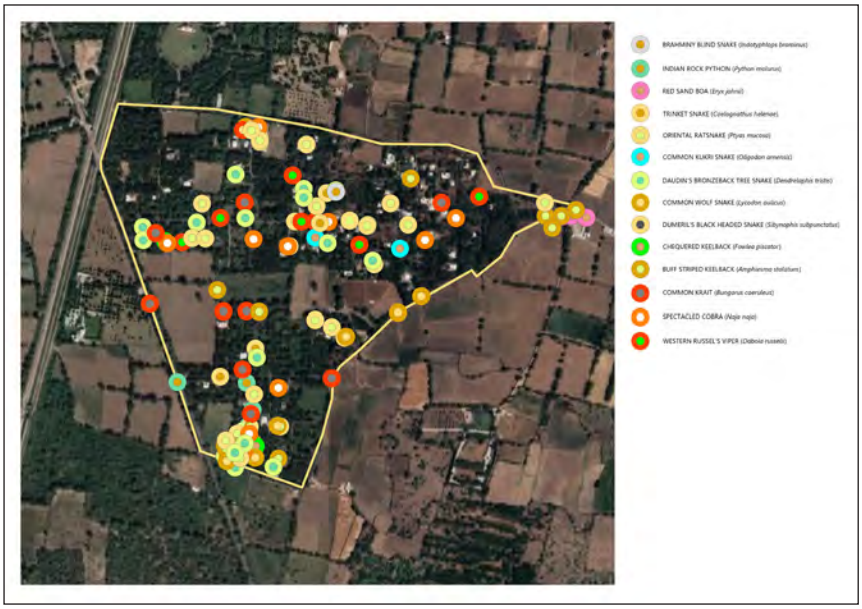
The snake diversity has been well documented across different landscapes in the state (Patel & Vyas 2019). However, a limited number of these studies were carried out in urban or peri-urban areas (Vyas 1987; Urfi 2005; Vyas 2013; Shroff 2016).

We attempted to document the diversity and distribution of snakes in a residential society called Suramya-3 (23.0557 N, 72.4272 E) encompassing an area of 84 acres (0.3 km^2) in the peri-urban western Ahmedabad. The number of residents and constructions have been limited, but the rate of constructions and inhabitants is now rising. This study was carried out to preliminarily understand the species occurrence, and subsequently sensitize the residents towards conserving these species. Surrounded by fields, and in proximity to important waterbodies, viz., Thol Bird Sanctuary, Palodia lake, and Narmada Canal, Suramya-3 boasts of diverse flora including grasses, herbs, shrubs, and trees like *Prosopis cineraria*, *Cassia fistula*, *Azadirachta indica*, *Syzygium cumini*, *Acacia nilotica*, *Holoptelea integrifolia*, *Albizia lebbeck*, *Cassia javanica*, *Salvadora persica* to name a few. Vertebrate fauna includes 12 species of mammals, about

Snake species observed in the study area: A—*Python molurus* | B—*Ptyas mucosa* | C—*Oligodon arnensis* | D—*Dendrelaphis tristis* | E—*Lycodon aulicus* | F—*Sibynophis subpunctatus* | G—*Coelognathus helenae* | H—*Amphiesma stolatum* | I—*Bungarus caeruleus* | J—*Naja naja* | K—*Daboia russelii*. © Rishit Shroff.



Map showing the location of the study area.



Map showing the locations of all snake species recorded during the study period in the study area.

100 bird species (both resident and migrant), approximately 20 species of reptiles that include turtles, lizards, skinks, and snakes, and commonly observed three frog species. The climate is typically dry tropical with four seasons-summer (March–June) with an average maximum temperature of 41° C, monsoon (July–September) with an average annual rainfall of 800mm, dry post-monsoon (October–November), and winter (December–February) with an average minimum temperature of 15°C (Shroff 2016).

The data were collected between June 2022 and June 2024 opportunistically through direct sightings while walking/driving, rescue calls, and images and observations obtained from fellow residents in the society. The first author is an authorized snake rescuer in Ahmedabad recognized by the state forest department, and is well versed in identifying and handling snakes for over two decades. The species identity was confirmed using Whitaker & Captain (2008). Data on the date, GPS location, time, species, length/size of the snake were recorded. Since most of the data was based on direct sightings, the length of the snakes to the nearest approximation (in metres) was ascertained in relation to the width of the road, and/or other objects in proximity. The age class (adult, sub-adult, or juvenile) was determined by the approximate length of the snake. The time of the sighting was further categorized into morning (0600–1200 h), afternoon (1200–1600 h), evening (1600–2000 h),

Table 1. Details of season-wise observations of snake species at Suramya-3 (June 2022–June 2024).

	Snake Species	Family	No. of sightings										Total observations
			2022				2023				2024		
			W	S	M	PM	W	S	M	PM	W	S	
1	Brahminy Blind Snake *Indotyphlops braminus* (Daudin, 1803)	Typhlopidae										1	1
2	Indian Rock Python *Python molurus* (Linnaeus, 1758)	Pythonidae			3								3
3	Red Sand Boa *Eryx johnii* (Russell, 1801)	Boidae			1	2							3
4	Trinket Snake *Coelognathus helenae* (Daudin, 1803)	Colubridae			4			1			1		6
5	Oriental Ratsnake *Ptyas mucosa* (Linnaeus, 1758)	Colubridae			11	3		7	5	6		4	36
6	Common Kukri Snake *Oligodon arnensis* (Shaw, 1802)	Colubridae				1		1		1			3
7	Daudin's Bronzeback *Dendrelaphis tristis* (Daudin, 1803)	Colubridae		1	3	1		5	7	1		3	21
8	Common Wolf Snake *Lycodon aulicus* (Linnaeus, 1758)	Colubridae			1	1		1	4			1	8
9	Dumeril's Black-headed Snake *Sibynophis subpunctatus* (Duméril, Bibron & Duméril, 1854)	Colubridae			1								1
10	Chequered Keelback *Fowlea piscator* (Schneider, 1799)	Natricidae			1			1					2
11	Buff Striped Keelback *Amphiesma stolatum* (Linnaeus, 1758)	Natricidae	1		4	3	1	2	5	1			17
12	Common Krait *Bungarus caeruleus* (Schneider, 1801)	Elapidae		1	2	2	1		7				13
13	Spectacled Cobra *Naja naja* (Linnaeus, 1758)	Elapidae		1	1		1	4	4	2		1	14
14	Western Russel's Viper *Daboia russelii* (Shaw & Nodder, 1797)	Viperidae		1		3	1	1		1		2	9
	Total of snakes encountered		**1**	**4**	**32**	**16**	**4**	**23**	**32**	**12**	**1**	**12**	**137**

W- Winter, S- Summer, M- Monsoon, PM- Post-monsoon

and night (2000–0600 h). Images were taken whenever possible. The distribution maps were created using CAD version: ARES STANDARD 2023 with Google Earth satellite imagery (Image © 2024 Airbus) as the base layer.

Based on 137 independent sighting records,

Table 2. Details of the time periods and age class of snakes observed at Suramya-3 (June 2022–June 2024).

	Snake Species	Venomous/ non-venomous	No. of sightings						
			Time period				Age class		
			Morning	Afternoon	Evening	Night	Adult	Sub-adult	Juvenile
1	Brahminy Blind Snake *Indotyphlops braminus*	Non-venomous	1				1		
2	Indian Rock Python *Python molurus*	Non-venomous				3			3
3	Red Sand Boa *Eryx johnii*	Non-venomous	2			1	3		
4	Trinket Snake *Coelognathus helenae*	Non-venomous	2		3	1	5		1
5	Oriental Ratsnake *Ptyas mucosa*	Non-venomous	22	7	7		30	3	3
6	Common Kukri Snake *Oligodon arnensis*	Non-venomous	1		1	1	2	1	
7	Daudin's Bronzeback *Dendrelaphis tristis*	Non-venomous	10	8	2	1	21		
8	Common Wolf Snake *Lycodon aulicus*	Non-venomous	1	1	3	3	5	3	
9	Dumeril's Black-headed Snake *Sibynophis subpunctatus*	Non-venomous	1						1
10	Chequered Keelback *Fowlea piscator*	Non-venomous				2	2		
11	Buff Striped Keelback *Amphiesma stolatum*	Non-venomous	5	7	4	1	15		2
12	Common Krait *Bungarus caeruleus*	Venomous	2		3	8	9	4	
13	Spectacled Cobra *Naja naja*	Venomous	6		7	1	8	6	
14	Western Russel's Viper *Daboia russelii*	Venomous	4	1	2	2	8	1	
	Total number of snakes encountered		**57**	**24**	**32**	**24**	**109**	**18**	**10**

a total of 14 species belonging to 14 genera and seven families were observed. The Oriental Rat Snake *Ptyas mucosa* was the most frequently encountered species, with the least number of observations of Brahminy Blind Snake *Indotyphlops braminus*, and Dumeril's Black-headed Snake *Sibynophis subpunctatus*. The majority (46.71%) observations were recorded during the monsoon months which is in consonance with previous studies in Ahmedabad (Urfi 2005; Shroff 2016), and mostly during the morning hours (41.60%). Adult snakes contributed to about 80% of the observations, while sub-adults and juveniles constituted the rest. Among all the observations, a miniscule proportion (5.83%) of snakes were recorded within built premises, with the rest being observed outdoors.

The most commonly observed Oriental Ratsnake *P. mucosa* showed a wide spread distribution pattern in the study area, as was the case with the Daudin's Bronzeback *Dendrelaphis tristis*, Common Krait *Bungarus caeruleus*, and Spectacled Cobra *Naja naja*. The Indian Rock Python *Python molurus*, and Red Sand Boa *Eryx johnii* exhibited a highly restricted distribution pattern. Trinket Snake *Coelognathus helenae*, Common Kukri Snake *Oligodon arnensis*, and Buff Striped Keelback *Amphiesma stolatum* showed a patchy occurrence. Western Russel's Viper *Daboia russelii* was recorded only in the northern region of the study area. Common Wolf Snake *Lycodon aulicus* depicted occurrence at the agricultural interface along the borders of the society. Checkered Keelback *Fowlea piscator* was recorded at two locations which were ~200, and ~500 m away from the closest water body, the Narmada canal, and over a kilometre away from Palodia lake. Out of the two occasions, one was during the monsoon, which may have allowed formation of water-logged areas in the society. Single observations each for the Brahminy Blind Snake *I. braminus*, and Dumeril's Black-headed Snake *S. subpunctatus* were recorded. All the species were mostly observed in habitats described in previously published literature (Whitaker & Captain 2008).

The present study shows that the snakes in the study area represent seven out of the 11 families of snakes in Gujarat, and constitute 14 of the recorded 67 species (Patel & Vyas 2019). The main caveat of the study was the method with which the data were collected, this combined with the low detection probability could mean that the presence of these 14 species in other locations, and other probable species may have gone unnoticed. For instance, a Common Cat Snake *Boiga trigonata* was observed recently in the premises in July 2024. The study however does generate a baseline for future monitoring. It elucidates patterns of seasonal occurrence and distribution which can help in conserving these species in this peri-urban area. One of the shortcomings of the study is the lack of exact explanations behind the distribution pattern. Further systematic observations on species abundance and distribution, as well as monitoring of microhabitat parameters are crucial to understand space use. This understanding can largely assist in contemplating species' requirements and movement patterns so as to benefit their conservation and avoid potential conflict. The study area remains exemplary in terms of human-wildlife coexistence chiefly owing to the limited resident human population. The first author remains involved in rescue operations and in generating awareness for snakes in the study area. The basic understanding of snake identification, biology, and myth busting continue to remain crucial for their conservation and this information are being disbursed among the residents. If snake conservation is to succeed in the study area, such activities are vital given the ever-increasing pressure on wildlife due to human settlements.

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Rishit Shroff[1] & Dhawal Mehta[2]
[1] FC-19, Suramya 3, Garodiya, Ahmedabad, Gujarat 382115, India.
[2] Department of Zoology, Bahauddin Government Science College, Junagadh, Gujarat 362001, India.
Emails: [1]rjshroff@gmail.com, [2]dhawalbmehta@hotmail.com (corresponding author)

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SARN
S. Asian Reptile Network
#262
21 December 2024

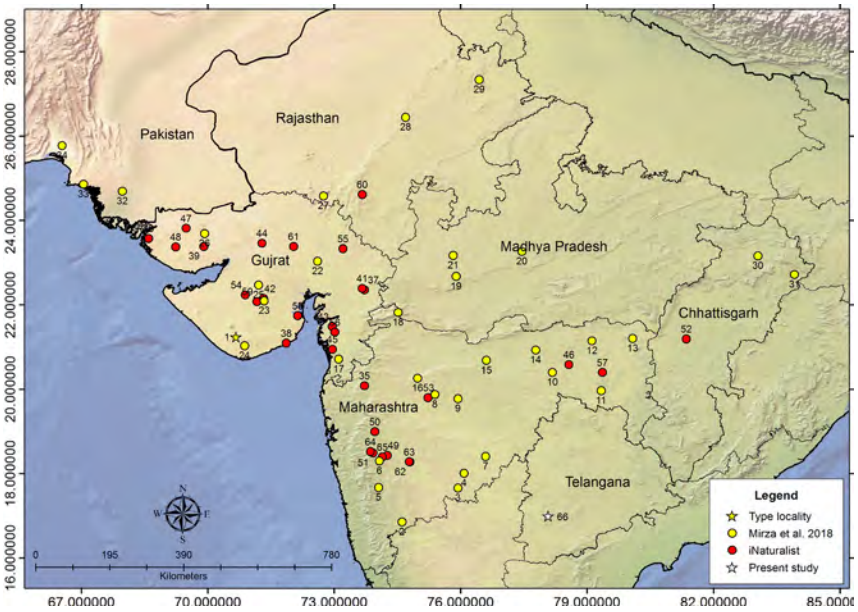
Record of *Hemidactylus* cf. *sahgali* from Telangana with a bifid tail

The recently described Sahgal's Gecko *Hemidactylus sahgali* is a member of the *Hemidactylus triedrus* complex inhabiting northern and western India (Mirza et al. 2018). Currently in India, this species has been reported from the states of Rajasthan, Maharashtra, Chhattisgarh, Madhya Pradesh, and from Sindh of Pakistan by Mirza et al. (2018). Additionally, several observations have been uploaded on iNaturalist platform by citizen science members (https://www.inaturalist.org/taxa/797687-Hemidactylus-sahgali), mostly from the same states of Gujarat, Rajasthan, Maharashtra, and Chhattisgarh.

Hemidactylus* cf. *sahgali **(IMG0368 – ZRC(IMG) 2.683a) photographed at Depalli Village, Nawabpet Mandal, Mahbubnagar District of Telangana State, India. © B. Laxmi Narayana.**

On 25 November 2023, at 1828 h, we photographed a live uncollected subadult male (SVL= 67 mm) Sahgal's Gecko *Hemidactylus* cf. *sahgali* in the agricultural lands in Depalli Village (16.9909 N &78.0790 E), Nawabpet Mandal, Mahbubnagar District of Telangana State, India. This individual was provisionally identified as *Hemidactylus* cf. *sahgali* based on diagnostic characters of dorsum in a shade of light brown with paired, broad, black-edged white bands at regular intervals and dorsal scalation on trunk, granular, intermixed with enlarged, keeled 15–16 trihedral tubercle rows arranged in fairly regular longitudinal series (Mirza et al. 2018).

Hemidactylus cf. *sahgali*:A—Dorsal view | B—Dorsal lateral view | C—Dorsal view of head | D—Lateral view of head | E—Ventral view of head | F—Mid-dorsal trunk with 15 keeled trihedral tubercle rows | G—Ventral region showing pre-cloacal opening | H—Ventral view of the lamellae of right pes | I—Ventral view of bifurcated tail | J—Doral view of bifurcated tail. Note: I & J—Y-shaped bifurcated tail with a leftward to perpendicular angle.
© B. Laxmi Narayana, L. Paramesh, Bharath Bhupathi & C.M. Deepak Tarun.



Map showing current known distribution records of *Hemidactylus* cf. *sahgali* in India and Pakistan, where the yellow star is Khambha, Gujarat (Type locality), yellow dots are distribution records presented by (Mizra et al. 2018), red dots are photographic records from the iNaturalist and the white star is the present new locality record of *Hemidactylus* cf. *sahgali* from Depalli Village, Nawabpet Mandal, Mahbubnagar District of Telangana State, India.

Digital image vouchers have been catalogued at the Zoological Reference Collection, of the Lee Kong Chian Natural History Museum, at the National University of Singapore (IMG0368 – ZRC(IMG) 2.683a and IMG0842 – ZRC(IMG) 2.683b). All the photographs were verified by Pratyush P. Mohapatra who confirmed them as *Hemidactylus* cf. *sahgali*, that is the closest to this than any other members of *H. triedrus* complex. Hence, we report a new locality record of Telangana State, India and also the first case of tail bifurcation in this gecko species from India.

However, even after the work of Mirza et al. (2018), there was no record of this species in published literature from Telangana State (Narayana & Bharath 2021; Srinivasulu & Kumar 2022). Hence, we present an additional locality record from the state of Telangana, India. Furthermore, the present study reveals the presence of *Hemidactylus* cf. *sahgali* in Telangana and extends the species' distribution range. We suggest further studies may reveal many more additions in adjacent states, also extended specimen examination with phylogenetic studies in the *Hemidactylus triedrus* complex may reveal a few more new

species form the other localities in the Indian subcontinent.

The gecko that we encountered had a bifid tailed with Y-shaped tail bifurcation with a leftward growth to perpendicular angle. Later, it was identified as *Hemidactylus* cf. *sahgali* with two tails. The basal part of the tail was apparently its original tail that was best with spiny tuberculate whorls, whereas the bifid portion was smooth indicative of a regeneration. Only one such case has been reported in *Hemidactylus giganteus* Stoliczka, 1871 from Adilabad District, Telangana (Kumar & Srinivasulu 2015). A few more records yielded from India in *Hemidactylus frenatus* from Tamil Nadu (Vishnu & Ramesh 2021), *Hemidactylus* cf. *brookii* from Surat City, Gujarat (Vyas 2016), *Hemidactylus* sp. from Dangs, Gujarat (Vyas 2016), and *Hemidactylus flaviviridis* from Odisha (Fullonton et al. 2024). Outside India some observations have been documented on tail bifurcation in *Hemidactylus frenatus* Duméril & Bibron, 1836 from Bangladesh (Khan 2004; Maria & Al-Razi 2018; Khandakar & Sultana 2020) and from introduced populations in Hawai'i (Chan et al. 1984), Honduras (Heyborne & Mahan 2017), and Mexico (García-Vinalay 2017).

Tail bifurcation in geckos, which is relatively rare, typically results from incomplete caudectomy. This condition may occur during an escape from a predator, where the injury is significant enough to trigger new tail growth (Arnold 1988; Meyer et al. 2002). Incomplete tail amputation leads to the regeneration of two tails instead of one, due to sufficient damage at the wound site (Kumar& Srinivasulu 2015). Other causes of tail bifurcation include spinal cord issues and genetic mutations (Brindley 1894). While bifurcated tails are uncommon in nature (Kornilev et al. 2018), they can have adverse effects on an animal's fitness. The tail is crucial for locomotion, balance, mating, foraging, and escaping from predators. Anomalies such as bifurcation can impair these functions, leading to potential disadvantages in the gecko's survival and reproductive success (Passos et al. 2014). Our observation of *H.* cf. *sahgali* from a new locality in Telangana, with a bifid tail is hence worth placing on record.

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B. Laxmi Narayana[1], L. Paramesh[2], Y.V.B. Charan[3], V. Hanumatha Rao[4], V. Vasudeva Rao[5], Bharath Bhupathi[6] & C.M. Deepak Tarun[7]

[1,7] Nehru Zoological Park, Bahadurpura, Hyderabad, Telangana 500064, India (Corresponding author: narayana.laxmi8@gmail.com) https://orcid.org/0000-0002-1167-3396

[2] Plant Systematics and Palynology Laboratory, Department of Botany, Osmania University, Hyderabad, Telangana 500007, India

[3] Sub office, Ministry of Environment, Forest and Climate Change, Aranya Bhavan, Hyderabad, Telangana 500004, India.

[4] Falcon Resilient Infra Consultants, 501A, Sudheer Tapani Towers, Opposite Telugu Academy, Old MLA Quarters Road, Himayatnagar, Hyderabad, Telangana 500029, India.

[5] Om Sree Signet, A 807, Yapral, Hyderabad, Telangana 500087, India.

[6] Freshwater Biology Regional Centre, Zoological Survey of India, Hyderguda, Attapur, Hyderabad, Telangana 500048, India.

Email: [1]narayana.laxmi8@gmail.com (corresponding author)

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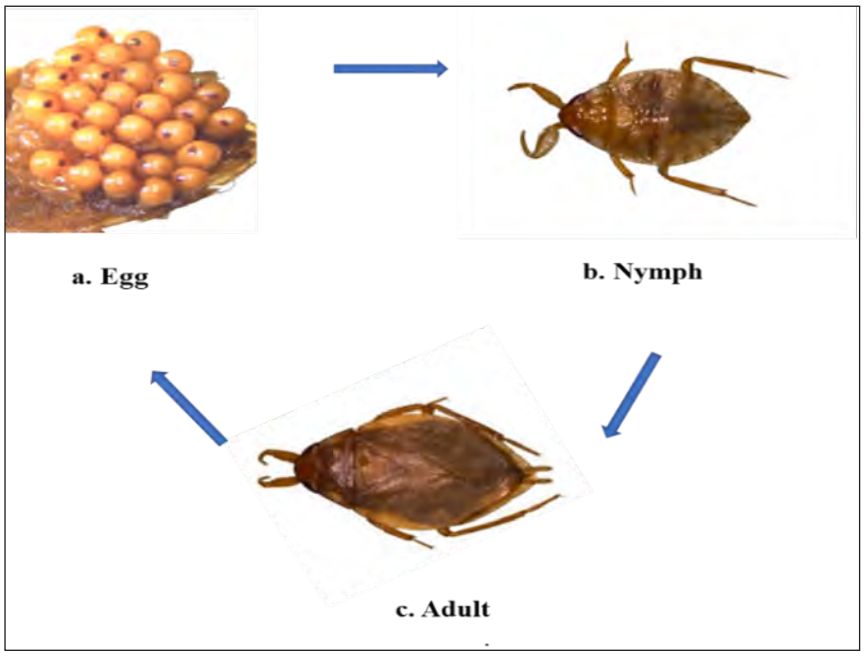
Aquatic bug *Diplonychus molestus* as potential bioindicators and biocontrol agents

The suborder Heteroptera are a set of about 45,000 species and more than 6,000 genera of insects among the order Hemiptera, also called as "true bugs". They are divided into three divisions based on their habitat preferences and ecological niche, that is terrestrial (Geocorisae), semi-aquatic (Amphibicorisae) and aquatic heteropterans (Hydrocorisae). The aquatic and semi aquatic heteropteran bugs are mainly inhabited in the water ecosystems, these are commonly called "water bugs".



Life cycle stages of *Diplonychus molestus* Dufour, 1863. © S. Ranjini.

The adult female water bug, *Diplonychus molestus* Dufour, 1863 belong to the family Belostomatidae, was observed in pond ecosystem of Thiruvalathur (10.7425 N 76.6868 E), Palakkad District, Kerala. Photographs were taken by using stereo-zoom microscope (Leica S8AP0).

The specimens were collected and identified with the help of available literature and taxonomic key (Chandra & Jehamalar 2012). It shows sexual dimorphism, i.e., adult males are usually smaller in size than females. They are hemimetabolous insect. The developmental stage completes from egg to nymph to adult and they produce one or more generations per year (Chen et al. 2005). They lay eggs on the dorsal side of the male bug and this male bug guard their eggs until hatching. The nymphal stage completes through the five instars to become an adult bug. The adult bugs can be easily distinguished by the division of the insect body. The life cycle of the water bugs may complete from 2–3 months (Chandra et al. 2017).

D. molestus Dufour, 1863 is an active predator and feeds on aquatic crustaceans, fishes, amphibians, and mosquito larvae (Chandra & Jehamalar 2012). The usage of the chemical pesticides against

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mosquitoes including larvae, will be eluted to aquatic habitats, which accumulates and magnify through the food chain and finally reaches the human beings (Pazou et al. 2013). So, in this situation, it is very urgent to find out and conserve the natural biological agents by using to decrease the population of mosquitoes. Few species under the Family Belostomatidae are active predators of mosquito larvae (Ohba & Nakasuji 2006) and these bugs may also be used in biomonitoring programmes (Corbi et al. 2011). This quality favours the *D. molestus* Dufour 1863 can be used as both bioindicators as well as biocontrol agents.

Around the world, freshwater habitats are being exposed to increase the levels of anthropogenic activities (Saunders et al. 2002) which leads to severe water pollution and finally affects the survival of different aquatic diversity. Aquatic biodiversity is one of the most important characteristics of an aquatic ecosystem for sustaining the ecological stability (Vinson & Hawkins 1998). They are very important as bioindicator species that characterize the health of an aquatic habitat and at the same time, they play a major role in maintaining the ecological balance. Water bugs are beneficial as bio-indicators as well as biocontrol agents, no doubt, more research studies are needed in the future to formulate the conservation strategies for these bugs.

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S. Ranjini
Research and Postgraduate Department of Zoology, St. Thomas' College (Autonomous), Thrissur, Kerala 680001, India.
Email: drranjinis@gmail.com

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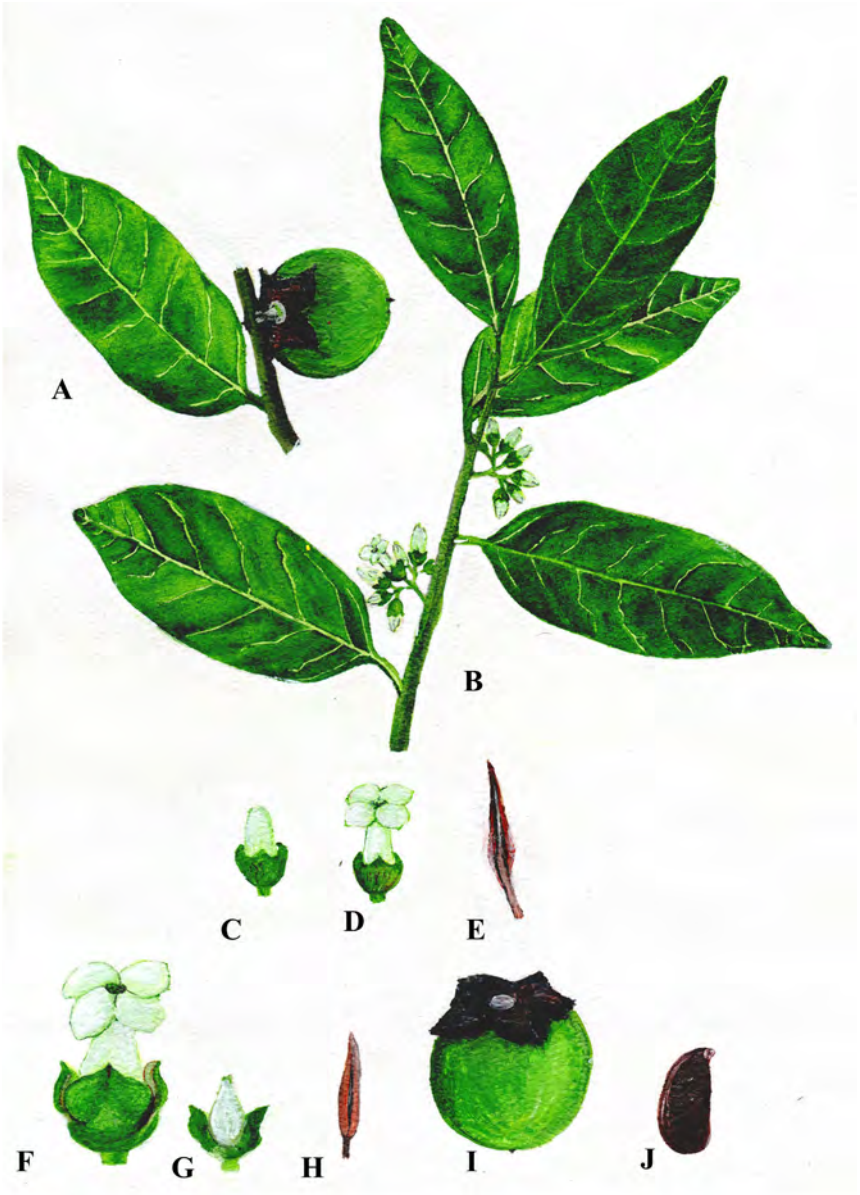
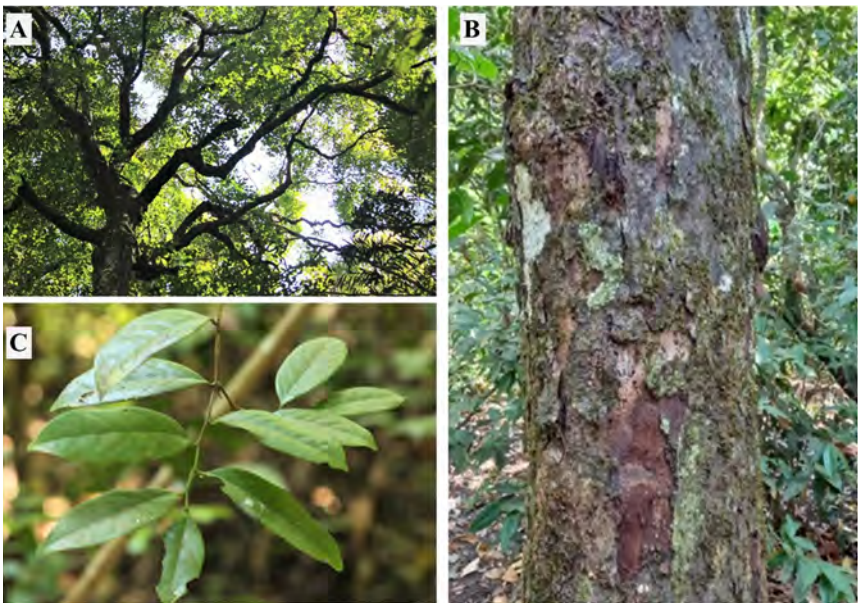
Taxonomic notes and illustration of *Diospyros crumenata*, a Critically Endangered and endemic tree species of the Western Ghats

Diospyros L. is the largest genus of the Ebenaceae family, comprising over 500 species, thus ranking as one of the largest genera of angiosperms (Turner et al. 2013). The primary centre of species diversity is located in Asia and the Pacific region, with approximately 300 species. Certain species within this genus, such as persimmons (e.g., *D. kaki*, *D. lotus*, and *D. virginiana*), bear edible fruits, while the wood of ebony (e.g., *D. ebenum*) is considered one of the most valuable timbers. The habit of the *Diospyros* L. species are typically found as shrubs or trees in various tropical and subtropical environments, where they often play significant and distinctive roles (Turner et al. 2013). India, for instance, hosts 66 species of *Diospyros* (Singh 2005), with 17 species displaying endemism. The Western Ghats region is acknowledged as a biodiversity hotspot, supporting a rich diversity of angiosperms, including 24 species of *Diospyros* (Gamble 1915–1936).



Hand painted illustration of *Diospyros crumenata* Thwaites. A—Female branch | B—Male branch with flowers | C—Male flower bud | D—Male flower | E—Stamen | F—Female flower | G—Gynoecium | H—Staminode | I—Fruit | J—Seed. © Shashwathi H.S.

According to global distribution record *Diospyros crumenata* is one of the Critically



A—Branching pattern of the tree | B—Bark structure | C—*Diospyros crumenata* habit. © Shashwathi H.S.

Endangered tree species which are endemic to southern Western Ghats and Sri Lanka. (Bachan & Devika 2023). They are commonly known as Kanthumari or Karithumari in Kannada. These trees are well known for their edible fruits. Wood is used for agricultural implements.

Prior to implementing conservation measures, acquiring comprehensive knowledge about each species is imperative. Therefore, the present research offers insights into the taxonomic characteristics and geographical distribution of these trees within specific regions of Karnataka, which forms part of the Western Ghats. This paper clearly gives the description, along with photographs and illustrations of the plant, serving as a valuable field guide for ease of identification to aid in conservation efforts.

Plant description

***Diospyros crumenata* Thwaites**.

Taxonomic Classification (APG IV)

Kingdom: Plantae

Sub kingdom: Pteridobiotina

Phylum: Angiosperms

Order: Ericales

Family: Ebenaceae

Genus: *Diospyros* L.

Species: *Diospyros crumenata* Thwaites

Habit: Evergreen trees which may grow up to 50–60 feet height and 70–90 cm girth. Dioecious in nature, Dark greyish coloured scaly bark where branches are not armed.

Habitat and Distribution:

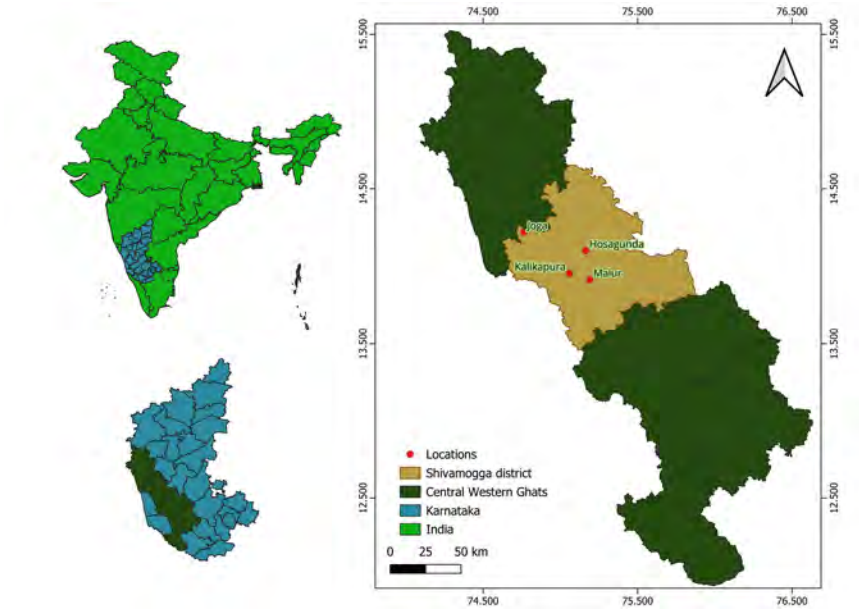
The trees were seen to be distributed in evergreen and semievergreen forests. Central parts of Western Ghats especially in Karnataka was taken for consideration of the study during 2022–2024.

The trees were observed in several forests of Shivamogga District. Random sampling with three belt transects of 250 × 4 m was studied in study sites. Joga, Hosagunda (Sagra Taluk), Kalikapura, Malur (Hosanagara Taluk) showed their presence. Location map

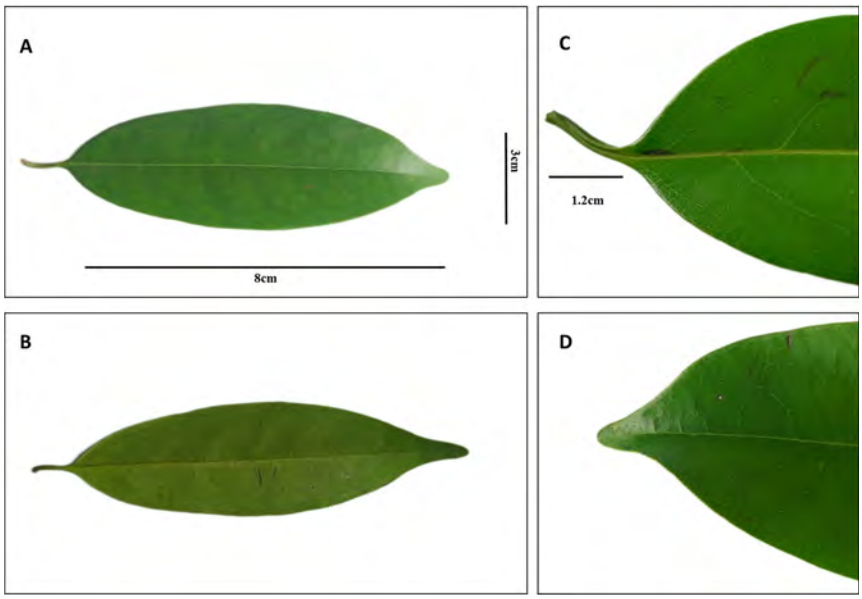
Table 1. Number of regenerating individuals and adult trees of *D. crumenata* in four different areas studied.

Study sites	Seedlings	Saplings	Poles	Adult trees
Hosagunda	9	16	18	13
Joga	6	5	4	4
Malur	8	13	9	5
Kalikapura	6	2	6	10

of these areas is depicted. Limited samples were collected and deposited as herbarium in Department of Botany, Kuvempu University with specimen voucher number KUAB807- ABDIO3 collected at Malur region (13.9106 N, 75.1911 E)Hosanagara Taluk, Shivamogga District, Karnataka. The number of individuals of *Diospyros crumenata* found in these four sites and number of regenerating individuals in seedling, sapling and pole stages are mentioned in Table 1.



Map showing the distribution sites of *Diospyros crumenata*.



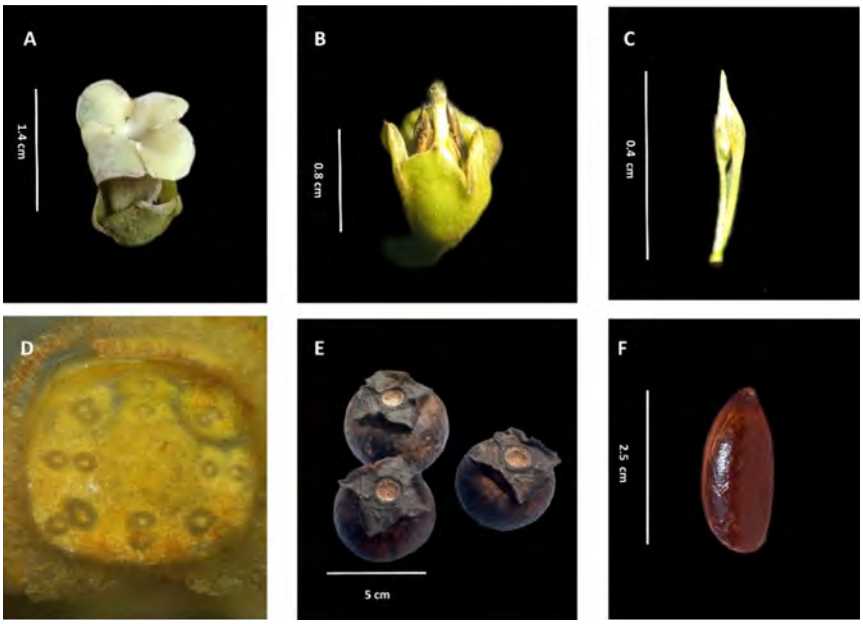
A–D—Leaf of *Diospyros crumenata*: A—Upper surface | B—Lower surface | C—Leaf base | D—Leaf apex. © Shashwathi H.S.

Leaves: Alternate, leaf blade – 7–12 × 3–5 cm, leaf shape elliptic or elliptically oblong, leaf apex – obtusely sub-acuminate, leaf base – obtusely cuneate, glabrous surface. Midrib –rounded at lower surface, grooved at upper surface near to base. Lateral nerves 8–10 pairs thin, indistinct near to apex and mixed with reticulation. Petiole – 0.8–1.3 cm long, grooved at upper surface, rounded at lower surface.

Inflorescence

Male Flowers: Cyme inflorescence with usually three flowers and sometimes five flowers are born on leaf axils, hairy. Peduncle- 0.3cm long, with short hairs. Pedicel – hairy, 0.1 cm. Calyx – 0.5–0.6 cm campanulate, pale green colour hairy outside, 4-lobed, acute, valvate. It is smaller in male flowers when compared with female flowers. Corolla – cream colour, 1.3 cm long, tubular and narrow at tip, hairy, 4 petals, twisted. Stamens 8–16 in number, free, 0.8 cm long. Anther – linear,

A—Male inflorescence | B—Male flower | C—Stamens with Pistillode | D—Stamen. © Shashwathi H.S.



A—Female flower: B—Staminodes and gynoecium | C—Staminode | D—T.S. of ovary | E—Fallen Dried Fruits | F—Seeds. © Shashwathi H.S.

0.3–0.4 cm long. Pistillode – hairy and rudimentary.

Female flowers: Solitary flowers at axils of leaf. Pedicel – 0.5–0.7 cm long, hairy. Calyx – 0.7–1cm long, cup shaped, broad, hairy, pale green colour, 4-lobed, folded outwards, valvate. Corolla-cream colour, 1–1.4 cm long, tubular, 4 petals, hairy, twisted. Staminodes – 8, unequal in length, 0.4–0.7 cm. Ovary – 8-celled, 1 ovule. Style – 4 with dense hairs. Fruit – 3–6 cm, globose, berry, green, hairs absent, hard, pulp is fleshy and fibrous, edible, persistent calyx. Seeds – 8, 2–2.5 cm, dark brown in colour.

Flowering and fruiting: January–March

Threats: As they are Critically Endangered, the main threats to *D. crumenata* are, the low number of reproductively active trees, poor recruitment of seedlings, irregular flowering and fruiting, low seed viability, and consumption of the fruits by tribal people and by wild animals (Jose et al. 2023).

Local conservation strategies

- These trees are commonly observed in sacred grooves which naturally conserve these trees.
- Prohibiting cutting of trees for agricultural implements may help in their conservation.
- Creating awareness among

local communities about these trees and encouraging to conserve them.

• Sustainable utilisation while using the fruits may help the trees for their reproduction and retaining their population.

• Including these trees in social forestry may helpful in conservation.

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H.S. Shashwathi[1] & Y.L. Krishnamurthy[2]
[1&2] Department of Applied Botany, Kuvempu University, Jnana Sahyadri, Shankaraghatta, Shivamogga, Karnataka 577451, India.
Emails: [1]shashwathisringeri@gmail.com, [2]murthy_ylk@yahoo.co.in (corresponding author)

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Corrigendum

Aishwarya S Kumar (2023). Memoirs of a *Pahadi* Adventure. *Zoo's Print* 38(9): 9-11; https://zoosprint.org/index.php/zp/article/view/7646/6901

The news update published in *Zoo's Print* 38(9): 9-11 "Memoirs of a *Pahadi* Adventure" <https://zoosprint.org/index.php/zp/article/view/7646/6901> had the following issues:

i) p. 10. A picture of *Fagopyrum esculentum* was given with a caption that read "Phaphru (*Fagopyrum esculentum*), a local delicacy which I no longer have the heart to taste after learning that the plant's invasive. © Aishwarya S Kumar." It should be noted that this plant species was wrongly mentioned as invasive in the article. It is in fact introduced.
ii) p. 11. The sentence "For instance, *Fagopyrum esculentum* (or 'Phaphru', as it's called in Chambyali, the local dialect) holds cultural significance and is used to make a local delicacy." Does not hold true the context. The plant is an introduced species to the region, not invasive.

First observation on geophagy by the Golden Langur at Chirang Reserve Forest, Assam

The Golden Langur *Trachypithecus geei* Khajuria, 1956 is a rare and endemic colobine monkey found in the western part of Assam, India, and south-central Bhutan at the Indo-Bhutan border, with its restricted distribution lying north of the Brahmaputra River, bounded on the east by Manas River, and on the west by Sankosh River (Chetry et al. 2010; Das et al. 2013). The Golden Langur occurs in tropical semi-evergreen and tropical moist deciduous forests, dipterocarp, riparian, & sal forests, and occasionally in degraded habitats with secondary growth (Srivastava et al. 2001). It is classified as 'Endangered' in the IUCN Red List (Das et al. 2024) and under Appendix I of CITES.

Adult female Golden Langur licking on soil. © Bishal Basumatary.

Juvenile male Golden Langur feeding on soil. © Bishal Basumatary.

The Chirang Reserve Forest (26.300–26.520 N & 90.150–90.250 E) under Bodoland Territorial Region (BTR), Assam is flanked on the west by the Saralbhanga River, on the north by the international boundary with Bhutan, on the east by the river Bhur, and on the south by National Highway 31. The Chirang Reserve Forest is in the buffer area of the Manas Biosphere Reserve and Ripu-Chirang Elephant Reserve (Das et al. 2013). Based on the different habitat types and floral composition, the vegetation composition of Chirang Reserve Forest can be primarily divided into dense tropical forests, with a variety of evergreen and semi-evergreen trees,

Adult female Golden Langur observing from tree canopy. © Bishal Basumatary.

moist deciduous forests, dry deciduous forests, Riparian Forests and degraded or scrub forest. Common species include *Shorea robusta*, *Tectona grandis*, *Dillenia indica*, *Ficus auriculata*, *Bombax ceiba*, *Toona ciliata*, *Oroxylum indicum*, and other tree species, contributing to a rich undergrowth. Additionally, the area supports a mix of shrubs, herbs, and climbers that create a dense understory, providing diverse habitats for wildlife.

The Golden Langurs were observed soil licking (geophagy) behaviour was observed in Chirang Reserve Forest during the survey around 1100 h on the way to Ultapani along the roadside just adjacent to a small culvert (26.694 N, 90.298 E) in the month of October 2023. A Golden Langur troop (10 individuals) was observed with six individuals lingering around the area on trees. An adult female with two juvenile males on the ground were licking soil and one adult female and a female sub-adult were observing from the distant trees. The surrounding habitat of the langur troop was a semi-evergreen forest full of shrubs, climbers, woody plants, and large trees. This is the spot where plenty of butterflies were found mudpuddling. The langurs went from the tree branch to the ground, leaned face down close to the ground and started licking the soil. Other two juvenile males also were feeding on the soil by picking up a small pinch with their fingers. The feeding bout lasted for six minutes. After feeding, all of them climbed back up the tree about 2.5 m above the ground and then jumped off to the next tree and disappeared from the site.

Chetry & Chetry (2009) reported soil feeding from Umananda Island of Assam which is outside the distribution range of Golden Langur. The present study is within the distribution range in the Chirang Reserve Forest of Assam. Further long-term study of Golden Langur feeding behaviour and soil analysis is required to understand the significance of soil licking behaviour of the Golden Langurs in Assam.

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Bishal Basumatary[1] & Hilloljyoti Singha[2]
[1&2] Department of Zoology, Bodoland University, Kokrajhar, Assam 783370, India.
Emails: [1]bishalbasumatary829@gmail.com (corresponding author), [2]singha.hilloljyoti@gmail.com

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Geophagy in Terai Langur at Morni Hills, Haryana

Geophagy is a common behaviour observed in primates, with several proposed explanations for its adaptive value, including mineral supplementation, detoxification of secondary plant compounds, adjustment of gut pH, counteracting endoparasites, antidiarrheal and aiding digestion (Krishnamani & Mahaney 2000; Wakibara et al. 2001).

Terai Langur licking salts from a wall at Morni, Haryana. © Sachin Ranade.

The Morani Hills are part of Shivalik Hills located in Panchkula District, Haryana State. The area is on the border of Himachal Pradesh, dominated with broad leaved trees and Chir Pines *Pinus roxburghii*. On 6 October 2024, during a field survey along the Nandpur-Badisher road (approximately 30 km), three distinct troops of Terai Langur *Semnopithecus hector* (Pocock 1928) were observed. The individuals had forward looped tail, moustachial stripe on face and uniformly pale grey hands as described for the species by Menon 2014. The troops were on the road, and most of the individuals were seen licking the roadside walls. These concrete walls are constructed for safe water drainage and to avoid landslides. The ground water from the uphill passes from the drainage openings in the walls during the four–five months of monsoon, and the minerals in it get deposited around the drainage openings. The langurs were noted licking these areas and, in some cases picking up small pieces of concrete and eating. I came across three troops with distance of about half a kilometre in between them. The groups were comprised of 8, 17 and 6 individuals and noted between 0900 and 1000 h, licking the concrete walls. Except an adult male on the sentry duty and infants with mothers, every individual (n = 28) licked the salts turn by turn.

The salt licking provides essential nutrients, relieve stress and helps to cure disease in animals (Matsubayashi et al. 2006; Tawa-Doi 2023). A study on geophagy in Nepal Grey Langur *Semnopithecus schistaceus* supported the hypothesis of acquisition of sodium salts rejecting the hypothesis of buffering stomach pH and detoxification (Monaco et al. 2019). A study in China on Yunnan Snub-

nosed Monkeys *Rhinopithecus bieti* also support the hypothesis of gaining extra supplement of minerals through geophagy (Li et al. 2014). The Terai Langur consume almost 90% plant matter and 10% as insect and soil, in their diet (Singh et al. 2020). The geophagy, as in other species, must be helping them to gain essential minerals and detoxification.

It appears that these form the first record of geophagy in Terai Langur with photographic evidence. It is a 'Near Threatened' species as per the IUCN criteria and needs detailed studies on the habitat and resource utilization. Morani Hills supports the westernmost population of the species and its conservation would be a valued initiative for the Haryana State.

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Sachin Ranade
Vulture Conservation Breeding Center, Rani, Kamrup District, Assam 781131, India.
Email: s.ranade@bnhs.org

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Blown away by a gust of wind

Of the 2,600 species of fireflies, very few synchronise their flashes. Male fireflies, perched on trees, flash in unison for hours, following rhythmic, cyclical patterns. But, on one particular night in 2022, nature broke this incredibly coordinated synchrony. That night in the Anamalai Tiger Reserve, there was frequent lightning and rain at a distance.

As I was observing the fireflies not being disturbed by the lightning, there was a loud howling sound usually associated with a Blown away by a gust of wind gust, but there was no gust. And suddenly, all the male fireflies perched on trees stopped flashing and their lights were continuously on. The trees were studded with points of yellowish-green glows. A couple of minutes later, there was a huge gust of wind that blew away all the fireflies from the trees. The forest was engulfed in yellowish-green sparks like snowflakes in a blizzard. The fireflies had their lights on as they were blown away, showing streaks of lights in this long exposure photograph.

The fireflies ended up on the ground and minutes later, there was a torrential downpour. Once it stopped raining, they went back up to the trees and continued synchronising.

Recorded by Sriram Murali of Wild and Dark Earth, an NGO that conserves nocturnal habitats in India. wildanddarkorg@gmail.com

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Address
Zoo Outreach Organisation
3A2 Varadharajulu Nagar, FCI Road, Ganapathy,
Coimbatore, Tamil Nadu 641006, India
Phone: +91 9385339862 & 9385339863
E-mail: zooreach@zooreach.org
Website: www.zoosprint.org, www.zooreach.org

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