Ecological Restoration in the Anamalai Hills

The Anamalai Hills are a rugged and biodiverse stretch of the Western Ghats. The landscape tells a complex story of fragmentation and resilience. The Nature Conservation Foundation (NCF) has been working since 2001 to heal the scars left on the landscape. As part of the Ram Hattikudur Advanced Training in Conservation we participated in an immersive two-day session on the 4th and 5th of December 2025, focussing on "Ecological Restoration" led by Dr. T.R. Shankar Raman and Dr. Divya Mudappa, who focus on restoring degraded rainforest patches among tea plantations on the Valparai plateau, adjacent to Anamalai and Parambikulam Tiger Reserves. Their work offers a blueprint for how science, patience and dedication can rebuild ecosystems after years of degradation.

Divya Mudappa & Shankar Raman's classroom session at NCF field station. © B. Ravichandran.

Restoration, as we learned, is not merely about planting trees. It is an attempt to reconstruct the biological and social values of a landscape. It requires identifying barriers to natural recovery, engaging local communities, and committing to long-term monitoring. The ultimate goal is to conserve biodiversity, revive natural ecosystem functions, and sustain multiple values for the community. However, the overarching philosophy remains clear: conserving existing natural habitats is always superior to attempting to rebuild them from scratch.

Shankar Raman's Classroom Session

The first day was dedicated to understanding the theoretical framework and the engine room of restoration: the nursery. Restoration is a specific, high-level goal that sits atop a ladder including reclamation, rehabilitation, regeneration, reforestation, and afforestation. True ecological restoration aims to return a site to a state similar to a "reference ecosystem." This reference is typically a site with little to no disturbance, identified through historical evidence and indigenous knowledge. For the NCF team, historical documents like the Flora of the Annamalai hills (1921) serve as vital guides for selecting the correct native species.

A crucial distinction was drawn between "active" and "passive" restoration. Passive restoration involves removing stressors (like grazing or fire) and allowing nature to heal itself. Active restoration requires intervention. However, measuring success requires moving beyond simple metrics like the number of seedlings planted. The team emphasized that better, more ecological metrics include the survival rate of native species, the recovery of forest structure, the return of wildlife and similarity with the reference site, in order to accurately assess the success of the project.

The Nursery

Our visit to the nursery gave us an insight into the meticulous care required to support this science. The practices here are governed by a strict ethic: never damage a healthy forest to fix a broken one. Seeds and saplings are collected only from roadsides, plantation edges, or disturbed areas.

Nandu, who's in charge of the nursery, explained that once collected, seeds are planted in germination bags within three days to ensure viability. The nursery utilizes

Srini and Nandakumar explaining to the RHATC team about nursery management. © B. Ravichandran.

a specific soil mixture of seven parts soil, two parts compost, and one part coco peat to grow the saplings. A layer of rock phosphate is added on top which aids the saplings in proper rooting and soil nutrient absorption. The plants are continuously watered as they germinate, but the frequency is reduced in the months before planting which in turn promotes resilience.

The nursery is a place of constant experimentation where they work with nearly two hundred native species, some of which remain stubborn. Hard-shelled seeds like nutmeg require cracking to sprout, while tiny seeds like Pongamia are spread in trays. As saplings grow, their roots are periodically trimmed which in turn, induces "root shock" in a controlled environment, increasing the plant›s stress tolerance and survival rate once transferred to the field. When planting in the restoration plot, they dig a pit, add compost, and sprinkle rock phosphate to further help saplings root properly and absorb nutrients.

One of the most interesting things that we came across was that the nursery does not arrange species in order; everything is mixed and the same goes while planting as well. This mimics natural diversity and acts as an insurance policy; if one species fails in the field due to disease or pests, others will survive. This stands in stark contrast to monocultures, which are highly vulnerable to pathogens. The nursery also maintains a genetic bank of regionally vital species, including Nageia wallichiana, Cullenia exarillata, Mesua ferrea, and various wild balsams and orchids.

Day 2

The LEMon (Long-term Ecological MONitoring) Plot: On the second day, we moved from theory to the field, visiting sites that showcased the challenges and triumphs of restoration on the Valparai plateau. Accompanied by K. Srinivasan (Srini), senior project manager of NCF's Western Ghats project, and Ahirbuhnyan, a new project assistant, we traveled to the western side of the plateau, where NCF manages a 120 ha area of abandoned pepper and vanilla plantations. This area has seen heavy agrochemical use, with networks of irrigation pipes buried in the ground. This site, contiguous with the Vazhachal Reserve Forest and Parambikulam Tiger Reserve, is critical for wildlife connectivity.

In 2015, this area was divided into 1 ha grids for systematic study and experimental treatments while

RHATC team at LEMon site.
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RHATC team at NCF Nature interpretation center.
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RHATC team at Kandura Photo monitoring plot.
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planting. For example, dibbling in some plots and regular weeding in others, as opposed to their usual method of active planting followed by minimal interference. One plot, called the «LEMON,» plot (Long-term Ecological MONitoring). Srini explained that this restored one-hectare plot, divided into 100 grids of 10x10 m, serves as a treatment site compared to a control primary forest plot in a protected area to examine the difference in ecosystem functionality between the two.

In the LEMON plot, the intense scientific rigor of the research is evident in the detailed mapping of every tree, using coordinates and correcting elevation errors with a theodolite. Dendrometers, which are metal bands attached to the tree trunks, are used to precisely measure girth growth with millimeter accuracy every quarter. For trees with buttresses, dendrometers are placed above the buttress, or a formula is applied to correct the error. The team also conducts Environmental Gas Monitoring (EGM) to track soil and tree respiration, analyzes leaf litter for nutrient cycling, and estimates carbon sequestration. They also monitor Coarse Woody Debris (CWD) along transects.

The restoration site, being a secondary forest, holds approximately half the amount of carbon compared to the primary control forest. We learned that young restoration sites often act as carbon sources before they become sinks, highlighting that restoration is a generational process. In addition to this, we saw the aggressive invasive herb Sphagneticola trilobita, which is a major challenge on the forest floor. Its dense, yellow-flowered mats prevent native tree seeds from reaching the soil, thus stopping natural regeneration. The key obstacle is clearing these mats without using herbicides, which would harm the catchment area.

Kandura

At the Kandura site, we witnessed the interaction between restoration and wildlife. Despite three years of effort, this plot showed few tangible gains because elephants frequently move through the patch, often stepping on the saplings. Conventional fences and tree guards proved ineffective against these giants.

However, the monitoring techniques were fascinating. Srini demonstrated the use of "photo-reference" monitoring using an app called FoMo, the team takes a photograph from a fixed point annually. By putting a see-through "ghost image" of last year's photo right on top of the current view, the photographer can line everything up perfectly. This method creates a really accurate visual timeline, showing positive or negative signs of forest recovery over the years.

Selaliparai and Rottikadai

The Selaliparai plot, planted in 2007, has transformed from a weed-infested patch of Lantana camara and eucalyptus into a thriving young forest (plantations have been leased). This plot was a clear vision into the

RHATC team at Salaiparai. © B. Ravichandran.

success of restoration. The success was underlined by the sighting of two Indian Giant Squirrels playing in the canopy, a clear biological indicator that the ecosystem›s function is returning. However, despite community engagement efforts, challenges persist as local people sometimes cut trees for poles used during temple festivals. Srini showed us a video of elephants moving through this small patch of just around one hectare, showing us how no forest is too small to support biodiversity. In contrast, the Rottikadai plot, started in 2024, showed the beginning of the journey. Here, the team used Clerodendrum infortunatum as a pioneer species after clearing invasive Lantana. Interestingly, some Lantana was deliberately left at the edges to act as a natural hedge, which initially seemed contradictory, but the team told that it serves as a natural fence to protect saplings from disturbances.

Conclusion

Our session concluded at the Anamalai Nature Information Centre. Established in 2007 and revamped in 2019, this space bridges the gap between hard science and public engagement. The centre features art by Rohan Chakravarty, Sartaj Ghuman, and Nirupa Rao, which translates the complex biodiversity of the plateau into accessible narratives. Rohan Chakravarty's Valparai Natural History Map particularly resonated with us. It weaves together diverse stakeholders of the land from tiny balsams and orchids to elephants and humans. It serves as a visual reminder that we are not outside observers of this ecosystem but active participants within it.

As we stepped out of the centre, a double rainbow stretched across the landscape. It was a fitting end to a session that taught us that ecological restoration is not just about soil and seeds. It is about resilience, scientific rigour, and the enduring hope that with enough time and care, we can help the rainforest heal itself.

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