

# Ancient Life Lessons

Why rainforests, millions of years old and one of the most diverse communities on earth, are crucial for our survival.

SUPRABHA SESHAN

It was a bright morning in late October, with a light breeze and no mist. Crinkled woody seeds of *todayan*, a beautiful tree with upturned leaves, cracked open underfoot as I walked through a rainforest at the Gurukula Botanical Sanctuary in Wayanad district, Kerala, where I live and work. Balsam capsules sprung open on touch. In the course of a few minutes, I had bumped into myriad creatures, such as assassin bugs, bagworms, hoverflies, fire ants and pill millipedes; a variety of spiders such as a giant wood spider, an ant-mimicking spider, a jumping spider, a tree-stump spider and a funnel-web spider; and birds such as bulbuls, drongos, fairy bluebirds, flowerpeckers, leafbirds and scarlet minivets. The breeze became stronger as the sun rose, tossing the tops of trees, while multicoloured frogs leapt out of my way. I stopped to admire *kattan kara* trees, close relatives of the *todayan*, in full flower.

Of the 67 acres of land in the sanctuary's care, seven acres consist of old-growth forest, namely an ancient forest that has never been clear-felled and has grown largely undisturbed over time. Every time I walk in this forest, I cherish the fact that this tiny stretch is primeval. Rainforests are the worlds' most ancient terrestrial biomes, or communities of distinctive plants and animals. Scientists estimate them to be 200 million years old, perhaps more. I tell children who come to the sanctuary for nature-immersion programmes that they are setting foot in one of the most ancient natural communities on the planet.

The rest of the Gurukula land is secondary forest, vegetation slowly recovering from clear-felling. Recovery began when each piece of land came under our care; the first pieces are about four-and-a-half decades old. From barrenness to baby forest, we have been witnessing the miracle of a forest reviving. More than 100 species of trees grow where once there was lemongrass or a ginger plantation. More than 400 species of herbs, shrubs, creepers, climbers and epiphytes have established themselves on this once-denuded land. Here too live 150 to 200 species of mosses and liverworts, while 240 species of birds have their homes or their annual wintering grounds on this land. Dozens of frogs, rare and fragile species, breed here, as do many lizards, snakes and mammals. I cannot even begin to describe the insects, except to say that we see new ones all the time.

**Sometimes life here can feel like a carnival, with crowd behaviour modulated by a fine sense of etiquette, arrived upon by mutual consent, by zillions of creatures feeding. Every space is busy, full of action: bacteria, worms, ants, spiders, trees, mosses, maggots, eggs, seeds, filaments of fungi, cohabiting creatures forming close-knit interdependent communities**

"After a period of time in Japan, when I arrive in the rainforest, the diversity is dizzying," said Sora Tsukamoto, an ecosystem gardener, who specialises in cultivating many species of plants in diverse families. He travels back and forth from his home country to the Western Ghats. "I almost feel a kind of motion sickness. The homogenisation of vast areas in Japan makes this Wayanad biodiversity incomprehensible at first, this sight of hundreds of species all together."

The sanctuary is contiguous with a reserve forest in the custody of the Kerala forests and wildlife department. This area, which is a couple of hundred square kilometres in size, consists of some old-growth forest, a much larger area of secondary forest, and other parts that had been cleared by the department a few decades ago to make way for plantations. The first logging in this part of Wayanad was undertaken more than 120 years ago by the British colonial administration, which cut ironwood trees to make sleepers for railway lines. Subsequently, the forest department's management practices have included clearing native trees for plantation species such as eucalyptus, acacia and mahogany.

Much of the work of the Gurukula Botanical Sanctuary, a forest garden, can be described as ecosystem gardening, a spectrum of strategies ranging from horticulture and plant conservation, to nature education and landscape-level restoration. The core idea here is that gardeners can help to heal ecosystems.

Ecosystem gardening at the sanctuary, and wherever it is practised the world over, has some basic ecological premises. The first premise is that nature evolves diversity over immense periods of time, a fact established by science. Diversity differs from biome to biome and habitat to habitat. It also changes with time and under different forces acting on the landscape, such as the reach of glacial sheets during the ice ages. On the flipside, diversity also influences climate and ecosystem processes.

The second premise, which has also emerged from numerous studies by evolutionary biologists, is that diverse species depend on each other to survive and thrive. Every level of life, from cellular to planetary, has communities of interrelated beings, each performing a unique function, together forming a whole, from genome to biome. In a rainforest, for example, the cool cover of vegetation on the land leads to water

condensing. This, gives rise to more plants, which in turn support more animals. Indeed, a primary rainforest, which has grown undisturbed for millions of years, like the one in our sanctuary, is among the most diverse places on earth. This is partly the work of time, and also the result of each species creating possibilities for more species.

A third widely shared premise among scientists is that diversity leads to resilience at different levels: of each species, of the whole community and also of the planet. Resilience is the capacity to survive challenges of different kinds, to maintain integrity of form and function through periods of adversity. Diversity, for instance, leads to multi-layered forests that are healthy; they do not succumb to outbreaks of disease.

“The first line of evidence is born out of Charles Darwin’s ideas,” explained Antonio Nobre, an earth systems scientist from Brazil, in an email. “Putting it roughly, natural selection has functioned over aeons to select organisms that correlate with environment stability. Individual fitness depends on group success, which depends on environmental stability. There is no other explanation for the observed climate stability on earth over billions of years.”

### Living Laboratory

At the sanctuary, I daily witness the three ideas working together. I walked on that morning to admire lichens, which are symbiotic organisms consisting of an alga, a plant, and a fungus, which is neither a plant nor an animal. Lichens grow on rocks or barks of trees, sustained by minerals and organic debris. Snails graze on lichens. Cormorants pick up snails. Eagles hunt cormorants, and bacteria, beetles, rats, worms and vultures feed on eagles after they die. So the feeding goes.

I then stopped by some *Oberonias*, a strange-looking genus of epiphytic orchids, with flat leaves growing fan-like from a sheathed base, and slender pendulous inflorescences. I find orchids to be great starting points to explore interdependence in nature. I examined a few closely, to look at their seed pods, which had taken weeks to mature. A few had split open. Orchid seeds are just motes of dust in the understorey, the layer of the forest beneath the canopy. Where they land, a specific fungus must grow or else they will not germinate. This is because orchid seeds lack an endosperm, the food package that starts off most flowering plants, like beans, corn and jackfruit, on their new life.

*Oberonias* grow on trees in the Western Ghats, following a lifestyle that is free of soil, deriving their minerals and organic matter from decomposed bark dust, and their water from rain and mist. Hence the term epiphyte, meaning a plant that grows on another plant. *Oberonia* flowers are two millimetres in length, and dozens can grow on a stalk. Each is a perfect miniature orchid. There are more than 20 *Oberonia* species growing in the Gurukula Botanical Sanctuary’s orchidarium, many named after botanists.

Every orchid species has a unique association with one or more fungal species known as mycorrhizae, meaning fungal roots. The seed swells when there is sufficient moisture, then releases a hormone, signalling the fungus to cover it with hyphae, which are filaments that behave like root hairs for the seedling. The fungus brings sugars, minerals, proteins and water to the seed. Germination happens, a cotyledon and radicle emerge, then a leaf shoot and root. Sunlight strikes the tender plant, and it grows.

Only when the plant grows bigger does the fungus receive its rewards in the form of carbon. Some biologists think that the fungus does not receive any benefits, but others disagree. This association between orchids and fungi is the reason you will never find orchid seeds for sale. It is impossible to grow them without the aid of micropropagation techniques and sugar solutions to replace the fungus’s role in a germinating seed’s new life.

“Saving any one of these orchids saves another species too, an insect perhaps,” said Suma Keloth, my colleague and an ecosystem gardener who has been growing and conserving hundreds of species of orchids for more than two decades at the sanctuary. Her wards are challenging, each one attuned to a precise set of conditions in the rainforest, and each one demanding attention, understanding, skill and sustained care. The proof of Keloth’s extensive knowledge of conservation gardening and plant diversity in the Western Ghats is tangible all around. Hundreds of species now self-propagate in mixed communities in the various habitats that she and other ecosystem gardeners have created in order to grow the plants.

Bryophytes, namely mosses and their relatives, offer another vivid example of interdependence. Rory Hodd, a visiting plant ecologist from Ireland, explained why they are crucial for the rainforest. Many of the bryophytes at Gurukula are epiphytes. They provide a substrate and home for many other organisms, and retain moisture that would otherwise be lost. Bryophyte colonies take time to grow. Once established they provide moist, stable conditions for orchids and ferns to germinate. They provide a home and food for fungi, algae, insects, which in turn are fed upon by frogs, birds and small mammals.

“In an ecosystem, everything is interconnected,” Hodd said. “If you remove an organism from the ecosystem, it loses its balance and, even if it’s not apparent to the observer, becomes less resilient to change. If this continues, and diversity of organisms continues to be lost, or if a major change to the ecosystem occurs, it ceases to function and catastrophe ensues.”

Piggybacking of organisms on other organisms reaches dazzling levels in the rainforest. My walk yielded many examples. An oak leaf fern grows on a *karivetti* tree. Its sterile fronds make baskets on the tree, trapping falling leaves from the canopy. The leaves break down with rain and wind, and form a natural compost. Its stiff leaves are tough

and protective. In this compost live fungi, beetles and worms, further transforming it. Frogs sometimes take up residence here too, feeding on the worms. Snakes come to feed on the frogs. Little seedlings of various flowering plants and even some trees can often be seen growing in the compost of the oak leaf fern perched high up on a tree.

### Human Factor

I think of the rainforest as a living Matryoshka doll. I see insertions upon insertions, extraordinary degrees of inter-nesting, myriad beings snuggling up inside each other, or upon one another, or under, or over, or intertwined. Sometimes life here can feel like a carnival, with crowd behaviour modulated by a fine sense of etiquette, arrived upon by mutual consent, by zillions of creatures feeding. Every space is busy, full of action: bacteria, worms, ants, spiders, trees, mosses, maggots, eggs, seeds, filaments of fungi, cohabiting creatures forming close-knit interdependent communities.

I have been learning that our bodies are quite similar; we are but giant Matryoshki. Far from being single individuals, we are instead fabulous ecologies, consisting of more than 10,000 species of tiny organisms. An ambitious Human Microbiome Project of the United States' National Institutes of Health investigates how microbes contribute both to health and disease in humans. These organisms number 100 trillion within a single human body, and supply more genes beneficial to our survival than our own human cells do: each one eating, each one metabolising, each one living and dying, so we all can be.

Yet modern humans live as if they do not need the natural world in all its astounding variety, revelling instead in the array of gadgets, machines and objects of consumption that proliferate in industrial civilisation. It is this civilisation that is destroying the diversity contained in the natural world. According to the International Union for Conservation of Nature, 150 species are going extinct *every day*, which is around 50,000 species a year. Although species have been going extinct since the beginning of life, the current rates are between 1,000 and 10,000 times faster than every previous extinction event. To calculate this, scientists track how many died out each year and compare this with the rate of disappearance of species from the fossil record before humans evolved. This erosion of diversity, experts agree, poses a huge threat to the survival of all life.

"Growing up in Holland is like a preview for our environment elsewhere," said Theun Karelse, an artist and graphic designer who visits the sanctuary every few years and uses seed balls packed with many kinds of seeds in a bit of manure, to diversify public spaces. "The pressure on our rural environment is so huge here. There is only what some ecologists refer to as green concrete. It looks green but holds little life. Biodiversity is now higher within our cities than outside. So in a way I feel like I can report from the bottom of the pit. And it's lonely there. Industrialised landscapes are

full of human infrastructure. I've come to see them as technologies of loneliness."

Is this what we want? Lonely industrialised places full of concrete, or landscapes full of life, diversity and health? Think of the world our children, and their children, will inhabit if we do not take action now.

I know what I want: a world with more forests every year than the year before, more health, vitality and beauty than the year before. The Gurukula forest shows me that this is still possible, and moreover, that it must be done. The encouraging fact is that diversity can be enhanced by every bit of forest that is restored, rehabilitated or protected. This is the nub of our work. How can we bring the cool oxygenating interior of the rainforest back onto the land? How can we bring health back to the biome? How long does this take: 10, 20, 35 years?

Of course, we can never fool ourselves that this is as good as primary forest. Regrown forest replete with native species, such as ferns, mosses, orchids, rattans, *kurunjis*, balsams, aroids, gingers and an assortment of shrubs, lianas and trees, is a powerful way to put ecosystem properties back on the land. But it can *never* replace old-growth forests, which have taken millions of years to achieve their stability, at scales that support planetary resilience.

Does this mean that the whole world should be a rainforest? By no means. Paradise could be an alpine meadow, or a temperate taiga forest, or a Mediterranean oak savanna, or a small still pool full of aquatic plants and animals. I am not an ecosystem or habitat supremacist. One habitat is not better than another, and we cannot say that any part of the natural world should be better protected than another because it harbours more species.

But I do declare my abiding love for my home in this rainforest, which gives me lessons on how time and diversity are related. Give a place at least 100 million years, and see the diversity that unfolds. I live in a neighbourly sense with creatures that have emerged over this vast span of time. They teach me what ancient really means.

Suprabha Seshan (suprabha.seshan@gmail.com) lives and works at the Gurukula Botanical Sanctuary in Wayanad district, Kerala. She is an Ashoka Fellow. In 2006, on behalf of the sanctuary's ecosystem gardeners, she received the UK's Whitley Award.

## Economic&PoliticalWEEKLY

available at

### Delhi Magazine Distributors Pvt Ltd

110, Bangla Sahib Marg  
New Delhi 110 001  
Ph: 41561062/63