FROM PEAKS TO VALLEYS: A HOLISTIC EXPLORATION OF THE WESTERN GHATS

Nestled along the western coast of India lies a natural wonder of unparalleled beauty and ecological significance: the Western Ghats. Spanning over 1,600 kilometers and covering an area of approximately 140,000 square kilometers, this ancient mountain range is not merely a geographical feature but a cradle of life, harbouring an astonishing array of flora, fauna, and cultural diversity.

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The Western Ghats are recognised as a global biodiversity hotspot and often referred to as the Great Escarpment of India, also holding the prestigious designation of a UNESCO World Heritage Site. The Western Ghats, also known as the Sahyadri Mountain Range, stretch from a latitudinal extent of 8°–22°N from the river Tapti in the north to Kanyakumari in the South. It encompasses regions in six States: Gujarat, Maharashtra, Goa, Karnataka, Kerala, and Tamil Nadu, and one Union Territory (Dadra & Nagar Haveli).

Topography and Natural Resources

The Western Ghats hold significant importance from several perspectives. One of its significant aspects is that its geomorphic value belongs to the Malabar Rainforest Biogeographic Province. Their positioning makes the Western Ghats biogeographically distinct and exceptionally biodiverse—a valuable repository of biological wealth. The Western Ghats are older than the Himalayas and hold the distinction of being an 'evolutionary ecotone,' providing evidence for both the 'Out of Africa' and the 'Out of India' hypotheses.

Renowned for their breathtaking topography, characterised by steep cliffs, undulating hills, deep valleys, and expansive plateaus, these mountains took shape millions of years ago during the collision of the Indian subcontinent with the Eurasian plate.

As a result of this collision, the land was thrust upward, giving rise to the majestic mountains of the Western Ghats. These mountains hold significant importance in the Indian landscape, serving as vital habitats for diverse plant and animal species while also contributing to climate regulation. The Western Ghats have an average elevation of around 1,200 metres (3,900 ft), with several peaks reaching heights of up to 2,600 metres (8,500 ft). Anamudi, located in Kerala, is the highest peak in the Western Ghats. The Western Ghats can be subdivided into three primary parts:

i. **The Northern Ghats:** The area extends from Gujarat to Maharashtra and represents the lowest and least rugged section of the Western Ghats.

ii. **The Central Ghats:** They extend from Karnataka to Kerala and represent the highest and most rugged section of the Western Ghats.

iii. **The Southern Ghats:** The area extends from Kerala to Tamil Nadu and represents the most dissected section of the Western Ghats.

The Western Ghats, spanning a vast expanse, are identified by a multitude of local names, reflecting the diverse languages and cultures of the region. Some of these unique names are:

i. **Sahyadri**: The meaning of Sahyadri is 'the abode of Sahya' (a mythological rain serpent), also known as the 'benevolent mountain' due to its verdant landscapes. This range stretches from Gujarat in the north to Maharashtra and Karnataka in the south.

ii. **Nilgiri Hills**: Signifying 'blue mountains', this name is attributed to the southernmost section of the Western Ghats, located at the junction of Karnataka, Kerala, and Tamil Nadu.

iii. **Sahya Parvatam**: In Malayalam, this term translates to 'Sahya Mountains' and is commonly used in Kerala, particularly in the southern reaches of the range.

iv. **Cardamom Hills**: Located on the Kerala-Tamil Nadu border, these hills derive their name from the cardamom plant, a prominent spice cultivated in the region.

v. **Anaimalai Hills**: Situated in the southern reaches of the Western Ghats along the Kerala-Tamil Nadu border, these hills derive their name from the Tamil word 'aanai,' meaning 'elephant,' symbolising the presence of wild elephants in the region.

These are just some of the many mountain ranges that make up the Western Ghats. Understanding these local names of mountains not only enriches our appreciation of the cultural significance of the Western Ghats but also underscores the profound connection various communities hold with this majestic mountain range.

The Western Ghats are abundant in natural resources that sustain both ecosystems and human communities. The region is a watershed for several major rivers, including the Godavari, Krishna, Kaveri, and Tungabhadra, which provide water for irrigation, drinking, and hydropower generation to millions of people. These mountains play a pivotal role in modulating India's climate by intercepting monsoon winds, preventing them from reaching the Deccan Plateau, and thus maintaining its

Grass Hills of Akkamalai

Gira Waterfall in Western Ghats of Gujarat

Saputara in Western Ghats of Gujarat

cool, dry conditions. Furthermore, the Ghats exert a significant influence on the ecological and biophysical processes throughout the entire Indian peninsula, shaping monsoon weather patterns across the country and exemplifying the tropical monsoon system. Acting as a natural barrier against rain-laden southwest monsoon winds during late summer, the Western Ghats perform crucial

Table 1: The dominant vegetation types of Western Ghats

Vegetation type	Elevation	Rainfall	Dominant flora
Tropical evergreen forest (west slopes)	200-1,500m	2,500-5,000mm	Emergents up to 60m; *Acrocarpus, Aglaia, Artocarpus, Calophyllum, Canarium, Cullenia, Dipterocarpus, Holigarna, Knema, Myristica*
Moist deciduous forest (most on high east slopes)	500-900m	2,500-3,500mm	*Bridelia, Pterocarpus, Sterculia, Tectona, Pterospermum, Lagerstroemia, Terminalia*
Dry deciduous Buchanania (east slopes)	300-900m	1000-2000mm	*Albizia, Anogeissus, Bauhinia, Butea, Dillenia, Emblica*
Scrub	200-500m	300-600mm	*Acacia, Carissa, Capparis, Flacourtia, Gardenia*
Shola	Above 1,500m	Medium to high	Short trees 15-20m: *Actinodaphne, Elaeocarpus, Euonymus, Michelia, Rhodomyrtus, Schefflera, Symplocos*
Grassland	1,700-1900m	Medium to high	Grasses: *Chrysopogon, Arundinella, Eulalia, Heteropogon*
Montane grassland	Montane	Very high	Herbaceous to shrubby cover: *Ligustrum, Rhododendron, Anaphalis, Strobilanthes*
Peat bog	<2000m	High	Grasses, sedges and mosses: *Carex, Cyanotis, Cyperus, Eriocaulon*
Myristica swamp	0 m to 600m	Medium to high	*Myristica, Knema, Hydnocarpus, Lophopetalum*

Source: World Heritage Datasheet

hydrological and watershed functions. It is reported that approximately 245 million people living in the peninsular Indian states depend substantially on water from rivers that originate in the Western Ghats, emphasising the crucial importance of this region's water and soil for sustaining the livelihoods of millions. Furthermore, the region is abundant in mineral resources such as iron ore, manganese, bauxite, limestone, and others.

Biodiversity

The Western Ghats, owing to their extensive length and geographical coverage, boast a rich and diverse biodiversity. It harbours one of the highest levels of endemism globally. Nair and Daniel, 1986, documented a total of 4,000 vascular plant species, of which 1,500 were endemic, accounting for 37.5% of the total. Specifically, of the nearly 650 tree species identified in the Western Ghats, 352 (54%) are found nowhere else. Animal diversity is equally remarkable, with amphibians (up to 179 species, 65% endemic), reptiles (157 species, 62% endemic), and fishes (219 species, 53% endemic), highlighting high levels of endemism. While invertebrate biodiversity, though not fully explored, is anticipated to be substantial, with approximately 80% of tiger beetles considered endemic.

The climatic and altitudinal gradient of the Western Ghats has led to a diverse range of vegetation types, including evergreen, semi-evergreen, moist deciduous, and dry deciduous vegetation. Based on ecological characteristics and plant composition, the Western Ghats region encompasses four major forest types and 23 different forest subtypes. The climatic and altitudinal gradient has led to a diverse range of plant types, including evergreen, semi-evergreen, moist deciduous, and dry deciduous forms. Briefly, the Western Ghats have the following forest types, (i) dry scrub vegetation (ii) dry deciduous forests (iii) moist deciduous forests (iv) semi evergreen forests (v) evergreen forests (vi) shoals; and (vii) high-altitude grasslands. Each of these forest types encompasses numerous subtypes, formations, or associations, highlighting a diverse range of floral compositions.

The Western Ghats stand out as one of India's key regions characterised by tropical evergreen forests, boasting immense plant diversity. Various researchers, including Gamble (1915-1936), Fyson (1932), Rao (1984), Nayar (1980, 1982 &1996), Mathew (1981-1984) Mohanan and Sivadasan (2002), and numerous others, have extensively documented the rich floristic diversity of this region. Moreover, several State and District floras have underscored the diversity and abundance of flora found here. It is estimated that approximately 12,000 species, ranging from lower groups to flowering plants are estimated to occur in this area. Among them, around 2,100 species are endemic flowering plants, out of a total of 5,800 flowering plant species in this highly endemic region. This represents roughly 27% of India's total flora. The floral species found in the Western Ghats shares a striking resemblance to the flora of Eastern Africa, Malaysia, and Sri Lanka. This floral affinity suggests a connection between the Western Ghats and the ancient landmass of Gondwana, which comprised South America, Madagascar, India, and the islands of Malaysia, Sri Lanka, Australia, and Antarctica. The historical linkage of peninsular India with these surrounding continents explains the distribution of certain genera such as *Hernandia, Lindenbergia, Pittosporum, Acrotrema, Gomphandra, Nothopodytes, Sarcostigma, Hydnocarpus*, and others across the Western Ghats, Africa, and even parts of South America. In India alone, there are approximately 1230 orchid species, with over 300 expected to be found in the Western Ghats. Notable ornamental species in this region include *Acanthephippium bicolor, Pecteilisgigantea, Rhynchostylisretusa, various species of Vanda, Dendrobium, Aerides, Eulophia*, and *Paphiopedilumdruryi*. However, ongoing exploration in the Western Ghats continually unveils new orchid taxa and reports, indicating the necessity for further investigation in various under-explored regions.

The Western Ghats boast an exceptional diversity of fauna, making them one of the world's biodiversity hotspots. The Western Ghats are home to a minimum of 325 species listed as globally threatened according to the IUCN Red List. This includes 229 plant species, 31 mammal species, 15 bird species, 43 amphibian species, 5 reptile species, and 1 fish species. Among these globally threatened species, 129 are categorised as vulnerable, 145 as endangered, and 51 as critically endangered. The Western Ghats are home to several flagship mammal species, including significant populations of globally threatened species such as the Asian

Elephant, Gaur, and Tiger. Additionally, the region hosts endangered species like the lion-tailed Macaque, Nilgiri Tahr, and Nilgiri Langur, which are unique to the area. Moreover, the Western Ghats play a critical role in conserving various threatened habitats, such as distinctive seasonally mass-flowering wildflower meadows, Shola forests, and Myristica swamps. Here's a glimpse into some of the fascinating fauna groups found in the Western Ghats:

Mammals: The Western Ghats are home to 139 mammal species, with 16 of them being endemic. Among the most threatened species are the Nilgiri Tahr, Lion-tailed Macaque, Gaur, Tiger, Asian Elephant, Sloth Bears, Nilgiri Langur, Indian Leopard, and Nilgiri Marten. The Malabar large-spotted civet is critically endangered.

Birds: There are 508 bird species in the Western Ghats, including 16 endemics. Notable species attracting ornithologists worldwide include the Broad-Tailed Grassbird, Nilgiri Wood Pigeon, Nilgiri Pipit, Black, Rufous-Breasted Laughing Thrush, Rufous Flycatcher, Crimson-Backed Sunbird, Malabar Grey Hornbill, and Grey-Headed Bulbul (Pujar, 2022).

Reptiles: Approximately 124 reptile species inhabit the Western Ghats, with Melanophidium, Teretrurus, Plecturus, and Rhabdops being common endemic shield-tailed snakes. Endemic venomous snakes include the Malabar pit viper, striped coral snakes, and the horseshoe pit viper.

Amphibians: Nearly 80% of amphibian species in the Western Ghats are endemic. Endemic frogs include the Malabar frog, Micrixalus, and Indirana, while Mercurana, Ghatixalus, and Beddomixalus are among the endemic tree frogs. Ghatophryne and Pedostibes are endemic toads.

Fish: The Western Ghats are home to over 288 freshwater and 35 marine fish species, with 118 being endemic. Of the freshwater species, 97 are threatened, with 12 critically endangered, 31 vulnerable, and 54 endangered.

Invertebrates: Over 331 butterfly species and 174 dragonfly species can be found in the Western Ghats, with 69 dragonflies being endemic.

Indigenous Knowledge System

The indigenous communities residing in the Western Ghats possess a vast knowledge of medicinal plants and their properties, accumulated over generations. This knowledge, often passed down orally through storytelling and practices, is crucial for their well-being and cultural identity. Several documented instances highlight the rich medicinal knowledge of the Western Ghats' indigenous communities.

For instance, the Kani tribe, an indigenous community living in the Agasthyamalai hills of the Western Ghats in Kerala, has been utilising the Arogyapacha (*Trichopuszeylanicus*) plant since the 1980s. The Kani tribe used the plant in an herbal remedy known as Jeevani.

The term arogyapacha literally refers to 'the green that gives strength.' The Kani tribe is aware of the plant's anti-fatigue benefits and consumes it during long treks in the Western Ghats. Research has found that the plant possesses anti-stress and immune-boosting characteristics, and can aid in improving endurance, combating tumours, and enhancing cellular immunity. *T. zeylanicus* attracted global attention due to being the first to use a benefit-sharing strategy with tribals for commercialisation. In 1994, the Jawaharlal Nehru Tropical Botanic Garden & Research Institute in Kerala filed a patent application with the Office of the Controller General of Patents, Designs, and Trademarks of India (IP India) for an herbal sports

Arogyapacha (Trichopuszeylanicus)

Traditional medicine practitioner locally-known as Bhagat in Valsad, Western Ghats of Gujarat

medicine based on compounds derived from the plant. The formula was developed into a commercial enterprise, and the tribe's Kerala Kani Welfare Trust receives licence fees and royalties.

Indigenous people of Valsad district, located in the Western Ghats of Gujarat, still use a large range of herbal medicines prescribed by traditional practitioners known locally as Bhagats in the treatment of various human and veterinary diseases.

The Soligas have been residing in a wildlife reserve in the Biligiri Hills of Karnataka among tigers and elephants for centuries. The narratives and principles of this group are valuable for rethinking conservation practices. The Soligas have learned to live peacefully with wildlife by using traditional methods passed down through generations. They can tell when it will rain by listening to bird calls and watching their flight patterns. They also know how to stay safe around tigers and elephants by recognising their behaviour and sounds. By respecting and worshipping plants and animals, they help keep the environment balanced and healthy. The Soligas take care of the forest and reserve some resources for the animals. For instance, they don't gather all the honey; they leave some for the animals.

It's essential to pass on the Soligas' knowledge to future generations and to learn from their experiences. This knowledge can help forest managers and conservationists better understand how to protect nature while also managing conflicts between people and wildlife. The Soligas' way of managing the Biligiri region provides the general public with a number of significant ecosystem services, including clean, fresh air and water to the densely populated areas nearby, sequestration of CO_2 and mitigation of climate change, and suppression of wildfires and soil erosion to safeguard the downstream cropping areas.

Their peaceful coexistence with wildlife shows us the importance of including traditional knowledge from tribal communities in our conservation efforts. The Soligas consider themselves part of nature and worship animals like tigers, elephants, and even trees and stones. This deep connection with the environment is evident in the beautiful landscape of the Biligiri Hills (https://www.iucn.org/news).

The mountain region's unique culture belongs to the Adivasi indigenous tribal people, whose traditional way of life is in danger. Several ancient dolmens, caves adorned with cave paintings, and megalithic burial sites can still be found in Chinnar. Additionally, Srivilliputtur Sanctuary boasts seven popular temples, while others in Agasthyamalai, Periyar, Talacauvery, and Someshwara attract numerous pilgrims. Notably, Ganga Moola in Kudremukh is revered as the source of three great rivers. Among the mountains, there are approximately 2,000 sacred groves (World Heritage Datasheet).

Threats

Despite their profound ecological importance, the Western Ghats are confronted with numerous threats that jeopardise their unique biodiversity and ecosystem services. Among the major concerns is habitat loss and fragmentation, primarily driven by the cultivation of coffee, tea, palm, rubber, and other crops, leading to widespread deforestation. The continuous depletion of forests renders the biodiversity of the region increasingly vulnerable, as flora and fauna lose their natural habitats to expanding urbanisation and industrial development.

Wildlife poaching, deforestation, overfishing, and livestock grazing further exacerbate the destruction of nature, causing irreparable harm to forest and aquatic ecosystems. Additionally,

the excessive use of agrochemicals in various plantations contributes to the deterioration of natural habitats. Moreover, the construction of railway lines, mining operations, and tourist infrastructure in the mountainous areas disrupts the delicate balance of natural harmony, posing additional threats to the Western Ghats' ecological integrity.

Conservation and Management

Through a robust legal framework, including laws such as the Environment (Protection) Act, Wildlife (Protection) Act, and Forest Rights Act, declaration of Eco-Sensitive Zone (ESZ) etc., efforts have been made to provide legal protection to wildlife and habitats, designate protected areas, and recognise the rights of forest-dwelling communities. Institutions and agencies like the Ministry of Environment, Forests, and Climate Change, State Forest Departments, and the National Biodiversity Authority play pivotal roles in overseeing conservation efforts across the Western Ghats. Specific initiatives have been undertaken, such as expanding the protected area network, implementing Project Tiger for tiger conservation, and launching national missions like the Green India Mission and the National River Conservation Plan. However, challenges persist, including the effective implementation of policies, balancing development with conservation, ensuring inter-state coordination, and addressing emerging climate change issues. Looking ahead, priorities include strengthening enforcement mechanisms, promoting sustainable development practices, enhancing collaboration among stakeholders, investing in research and monitoring, and addressing the challenges posed by climate change. Collaboration among the Government, local communities, NGOs, and other stakeholders remains crucial for the successful conservation of the Western Ghats. ❑

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