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Faunal Diversity in Western Ghats, India: A Review

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ABSTRACT

The term "Biodiversity Hotspot" refers to a geographical region with a high level of diversity and a large number of endemic species that have been overexploited over time. India has four biodiversity hotspots: the Himalayan biodiversity hotspot, the Indo-Burma biodiversity hotspot, the Sundaland biodiversity hotspot, and the Western Ghats biodiversity hotspot. Human activities have significantly impacted the biodiversity of these hotspot regions. Therefore, it is important to conserve these areas to ensure the survival of various species and the future well-being of both organisms and humans. The Western Ghats is considered the most diverse hotspot in India and is renowned for its unique and rich biodiversity. Among the invertebrates in the Western Ghats, land snails are particularly important, but they have been rarely studied or exploited. There are 270 species of snails in the Western Ghats, with 204 of them being endemic to the region. Additionally, out of the 330 species of butterflies in the area, 37 are endemic. The Western Ghats also supports a high level of endemism in reptiles and amphibians. However, the level of endemism is lower in mammals compared to other groups of organisms. Several endemic species in the Western Ghats, such as the lion-tailed macaque (*Macaca silenus*), Malabar civet (*Viverra civettina*), Nilgiri tahr (*Hemitragus hylocrius*), and Red slender loris (*Loris tardigradus*), are facing significant threats and are classified as "vulnerable" or "endangered." Today, the life-sustaining and biodiversity-rich ecosystems of the Western Ghats are under threat due to habitat pressures, leading it to be declared as one of the world's hottest hotspots of biodiversity.

KeyWords: Endemic, Hotspot, Anthropogenic, Biodiversity, Vulnerable.

INTRODUCTION

Diversity of organisms exists at various levels, including genetic diversity, species diversity, and ecological diversity, which are found in aquatic, terrestrial ecosystems, and even outer space. While every place has diversity, the degree of diversity varies among different locations. Geographical regions with a higher extent of diversity and the maximum number of endemic species that have been overexploited over time are called "Biodiversity Hotspots". The wealth of the earth is crucial for every living organism. Increased anthropogenic activity is one of the most significant causes of the decline in the earth's health. The increased human population and urbanization lead to the creation of toxic substances that negatively affect other organisms on the earth. Scientists have listed a huge number of species in the IUCN Red Data Book that are extinct, and they warn about a significant number of extinctions of wild organisms. India is considered one of

the mega-diverse countries, with four biodiversity hotspot regions: the Himalayan biodiversity hotspot, Indo-Burma biodiversity hotspot, Sundaland biodiversity hotspot, and Western Ghats biodiversity hotspot. Hotspot regions contain the maximum biological diversity of any region and also have the highest number of endemic organisms. Anthropogenic activity significantly influences the biodiversity of hotspot regions. Thus, proper conservation of the hotspot region is important for the biodiversity and future existence of other organisms and human. Here Myers was concerned with saving endemic plant species unique to tropical forests, not biodiversity perspective, but he makes the case that densities of endemic species are particularly high in tropical forests, and, therefore, such sites should be given priority in conservation efforts. In this first attempt, Myers identified ten specific regions of tropical forests he designated as hotspots which possessed exceptionally high levels of endemic plants and were threatened with significant habitat loss. Here Myers treats biodiversity as a quality of intrinsic value associated with these areas, something that ought to protect for its own sake. Further, the hotspot concept he joins to it is itself a conflation of three different and more or less independent concepts: the concept of endemism-dependent rarity (a concept focusing on individual endemics), the concept of biological diversity (the number of species per unit area) and the concept of vulnerability (the prospect of imminent loss without immediate conservation action). In this article, we discuss the invertebrates and vertebrates of Western Ghat biodiversity hotspot.

CRITERIA FOR DETERMINING HOTSPOT

- A biodiversity hotspot must support nearly 60% of the world's plant, reptile, amphibian bird, and mammal species, and it must be sharing a high level of endemism. (i.e. the species confined to that area and not found elsewhere).
- The amount of habitat loss is an indicator of hotspots it called as Degree of threat.
- The site should include a diverse range of habitats.
- Specialist species should be of adequate amount.
- These areas should contain important gene pools of potentially useful animals or plants of value to people.

DISTRIBUTION AND ECOLOGY OF WESTERN GHATS

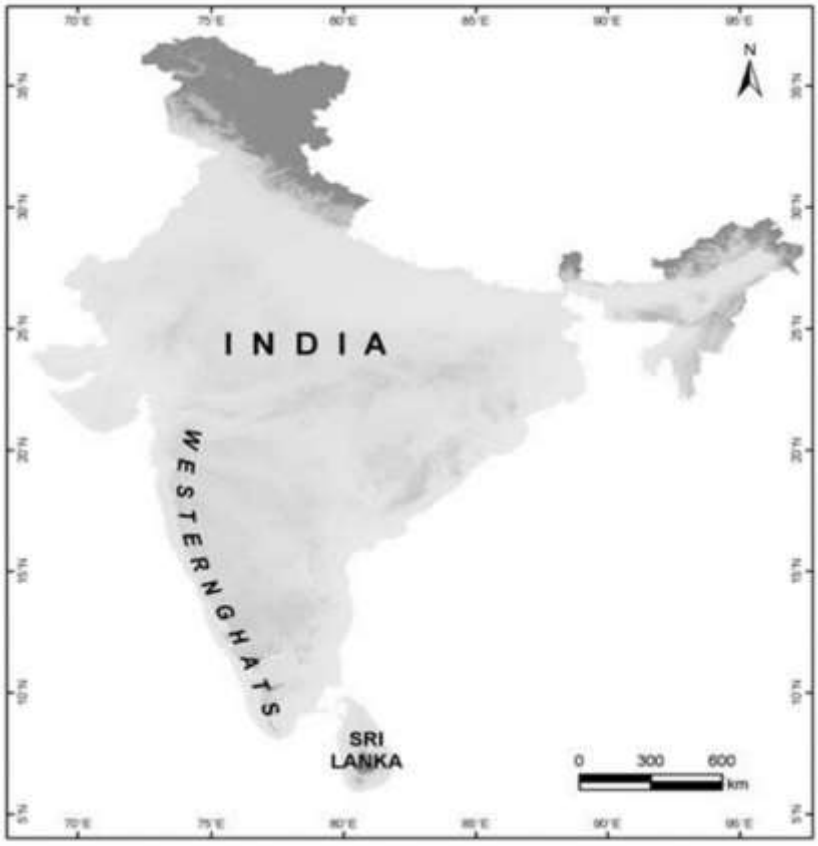

Fig 1. Map showing the Western Ghats hotspot (Source: Institut Francais de Pondichery).

According to this criterion, 34 hotspots have been identified all over the world, with most of them located in tropical areas (Mittermeier et al., 2011). Williams et al. (2011) identified the Forests of East Australia as the

35th hotspot on the list of Earth's biodiversity hotspots. Bawa et al. (2011) measured that the Western Ghats cover approximately 180,000 square kilometers, which is 6 percent less than the total area of the Indian subcontinent. India is declared as a mega diversity country, as it holds several species, with the Western Ghats supporting 30 percent of all species present in India. The Western Ghats are considered the most diverse hotspot in India and are well known for their unique and rich biodiversity. The western ghat biodiversity hotspot is distributed along the western coast of India in the Malabar plains. The highest peak of the Western Ghats has a height of 2969 meters, with an elevation ranging from 900 to 1500 meters (Nameer, Molur & Walker, 2001). While a large number of species diversity is present in this hotspot region, increasing anthropogenic activity is reducing the volume of species diversity and forest area. Concern from each level, such as legal concern and concern of individuals, is required for the conservation of the Western Ghats biodiversity hotspot. The landscape of the Western Ghats is unique in terms of biology, geology, ecology, and geomorphology, and the high level of rainfall precipitation makes the Western Ghats a magnificent mountain range and one of the most ecologically diversified landscapes.

FAUNAL ENDEMISM IN WESTERN GHAT

Invertebrates and vertebrates are some of the most important elements of any ecosystem, and they reserve most part of the biodiversity. The diversity of species depends on several natural factors such as precipitation, temperature, sunlight, soil content etc. (MAppSci., 2012). The whole region of Western ghat is stated as an ecologically sensitive zone (ESZ) by Western Ghat Ecology Expert Panel (WGEEP), and they divide the level of sensitivity into three zones. Those zones are ESZ1, ESZ2, ESZ3, and they classified depending on the environmental condition for wild organisms (Gadgil et al., 2011).

Hotspot original extent	189,611
Hotspot vegetation remaining	43,611
Human population density (people/km^2)	261
Area protected (km^2)	26,130
National Park	20
Sanctuaries	68
Biosphere reserve	01

Table 1. Overview of Western Ghats.

Taxonomic Group	**Species**	**Endemic species**	**Endemism (%)**
Mammals	140	18	12.9
Birds	458	35	7.6
Reptiles	267	174	65.2
Amphibians	178	130	73.0
Freshwater fishes	191	139	72.8
Land snails	269	204	75.8
Freshwater snails	77	28	36.3
Butterflies	332	37	11.1
Odonata	174	69	39.6
Ants	350	70	20.0

Table 2. Faunal Endemism in Western Ghats.
[Source: Conservation International: www.conservation.org & www.cepf.net]

Invertebrates

Bawa et al., mention in their study about both the terrestrial and aquatic invertebrates in Western Ghats region. They also stated that IUCN could not enlist any freshwater invertebrates in Red List, while invertebrates were equally affected in hotspot region by anthropogenic activity. In recent times, most of the invertebrate research conducted on ants and butterflies.

Snails

Land snails are one of the most important invertebrates in Western Ghats those rarely exploited and studied. In different time few scientists explored several molluscan species. Ramakrishna et al., (2010) stated that a count of 1129 species of snails is present in India those are belonging to 140 genera and 26 families. While 270 species of snails reserved in Western Ghats, among those species 204 are endemic to this region.

Cyathopoma is a snail genus which is only present in Western Ghats such 41 per cent of total genus of land snail present here are endemic (Madhyastha, Mavinkuruve, & Shanbhag, 2004). Molluscs are one of the most sensitive organisms and they tend to localise to a particular location. This characteristic is one of the most important causes of their extinction, and another important cause is anthropogenic pressure.

Insects

Insect diversity holds an important place in the list of most diverse organisms on Earth. Insects are present in both terrestrial and aquatic ecosystems. Balachandran et al. (2014), mention in their study about the aquatic insects, they stated that aquatic insects are the most important organisms in aquatic ecosystems those are help in the decomposition of organic matter. Insects are recognised as a good indication of the ecosystem. Butterflies are another important insects those are having 330 species in Western Ghats. Among the 330 species, 37 butterfly species were recorded as endemic. Butterflies have importance in wild ecosystem, because they serve as the pollinator in forest ecosystem. The authors mention that 200 species of spiders habituated in the Western Ghats. Ants are the insects, which hold approximately 20 per cent of the biomass in the tropical region. A list of 210 ant species recently documented in Western Ghat and Sri Lanka. Odonata shows a high level of diversity in Western Ghats (Gunawardene et al. 2007). 223 species of Odonata are habituated in Western Ghat and Sri Lanka region. Among the Odonata, 43 perecnt is endemic to this biodiversity hotspot. Insects are sensitive to unfavourable weather condition. Increase anthropogenic activity causing threats to the insect families. Thus, proper concern on this matter is important and more study is required to collect more information about the species diversity of Western Ghat hotspot.

Vertebrates

Western Ghat supports a vast number of aquatic and terrestrial vertebrates. According to Roy (2021), this biodiversity hotspot region includes approximately 315 species, those are endemic to Western Ghats. According to his study, the Western Ghats is a reservoir of 458 species of birds among which 35 is endemic. It also supports 140 species of mammals, 178 amphibian species, 267 reptile species and 191 fish species. Western Ghats supports a high level of endemism in reptiles and amphibians. Thus, this bio-diversity hotspot supports both aquatic and terrestrial vertebrates. The present decline in the natural factors spontaneously increased the threat of all levels of organisms in Western Ghats.

Fishes

Fish diversity in Western Ghats shares a big contribution to be a biodiversity hotspot of its. Gunawardene *et al.* suggested that the diversity of fishes in all part of the Western Ghats is not equally distributed. According to their study, southern western part of the Western Ghats is more diverse with fish species than the central and northern regions. It is well known for its ornamental fish production. Denison barb (*Puntius denisonii*) is the most important ornamental fish for trade (Roy, 2021). According to Yadav (2000), a huge number of fishes are threatened and endemic in the Western Ghats region. In his study, he stated a list of 51 species those are threatened lives in Western Ghast, and 40 among these 51 species are endemic. Some of the endemic fishes are *Danio fraseri*, *Barilius evezardi*, *Gonoproktopterus curmuca*, *Labeo potail*, *Puntius deccanensis* etc. He also stated that increased anthropogenic pressure and heavy industrialisation raise the threat of extinction of endemic species. The immediate reduction of extinction of the endemic fish species required.

Amphibians

Amphibians are one of the most important indicators of the health of any region, due to their interaction with several environmental factors (Krishnamurthy, 1996). Western ghat supports various amphibians with different characteristics and different habitats. It means some of the amphibian species are mostly aquatic such as *Occidozyga cyanophlyctis*, some are semi aquatic for an example *Rana keralensis* and some are terrestrial such as *Bufo melanostictus*. According to Dinesh & Radhakrishnan (2011), Western Ghats support 157 species of amphibian those are categories into 11 families and 27 genera. The 11 families of amphibian are namely Bufonidae, Dicroglossidae, Micrixalidae, Microhylidae, Nasikabatrachidae, Nyctibatrachidae, Ranidae, Ranixalidae, Rhacophoridae, Caeciliidae and Ichthyophiidae. Among these families, three are endemic to the Western Ghats, those are Micrixalidae, Nasikabatrachidae and Ranixalidae. They also stated that eight species are critically endangered. *Ansonia rubigina*, *Rana curtipes*, *Bufo parietalis*, *Rhacophorus malabaricus*, are endemic amphibian species in Western Ghats (Abraham *et al*., 2001). It suggested by previous author, that aquatic and semiaquatic amphibian species are predominant species in the Western Ghats. Enormous changes in environmental conditions and characteristics in aquatic parameters increase the

threat for the Amphibians. Krishnamurthy (1996) stated that the southern part of the Western Ghats is more diverse that the other part of the Western Ghats.

Reptiles

Reptiles of Western Ghats are diversely located in the different parts of this region. Ganesh *et al.* stated in their article that the central Western Ghats populated with 71 reptile species. It is unfortunate during the British period that only four species of Western Ghats is explored. Some important reptilian species from central Western Ghats are *Geckoella albofasciata, Cnemaspis goaensis, Hemidactylus prashadi, Calliophis castoe* etc. In 1997, Radhakrishnan first enlisted the list of reptiles of Western Ghats, who document 169 species of reptiles. Palot (2015), stated that interest in Western Ghats reptiles has increased with time. The author mentions the 173 species represented as reptilian species in Western Ghats. Jayakumar & Nameer (2018), stated that reptiles of Western Ghats are more active at night than the daytime. Kumar *et al*. (2018), stated that reptiles in western ghat are highly infected with tick vector. These are some of the most important causes of reptilian diseases in Western Ghats, it also impacts on the diversity of reptiles. Several reptilian species are endemic in Westen Ghat such as *Vijayachelys silvatica, Eryx whitakeri, Cnemaspis indraneildasi, Rhinophis sanguineus, Dendrelaphis grandoculis, Draco dussumieriil.* According to their study, 36 endemic reptilian species were recorded in Western Ghats.

Birds

India is one of the mega-diversity countries, holding four biodiversity hotspots. The Western Ghats region in India has the highest number of endemic avian species (Karmakar, Bhattacharya & Karmakar, 2010). The authors calculated that the diversity of avian population in the Western Ghats is 0.003/km2. Some of the most important and endemic avian species in the Western Ghats are *Myiophonus blighi, Centropus chlororhynchos, Leptoptilos javanicus, Pelecanus philippensis, Garrulax cachinnans,* and *Ficedula subrubra*. Jayson & Mathew (2003) mentioned a direct relationship between the foliage and the number of bird species. Their study shows that an increased foliage in the forest leads to an increment in the bird population. They also stated that birds are highly attracted to the foliage rather than the higher canopy of the forest. Some parts of the Western Ghats are isolated by geographical attributes from the mainland, and this isolation impacts the biodiversity of the region. Santharam et al. (2014) mentioned the bird diversity of Sirumalai hills, concluding that isolated regions show different biodiversity patterns. However, these regions are more threatened in terms of species diversity; for example, increased hunting in these regions can easily reduce species diversity. Avian species are important indicators of environmental changes. The composition of birds in a forest highly depends on the vegetation of the forest. Increased diversity and complexity in vegetation positively impact the diversity of birds. Harisha & Hosetti (2009) conducted a study and mentioned 132 bird species, 12 of which are migratory. They stated that the landscape and season influence species richness. For example, hill Myna was more prevalent in the Lakkavalli range forest, followed by the Malabar parakeet, purple-rumped sunbird, and plum-headed parakeet.

Mammals

Mammals of Western Ghats show lower level of endemism in comparison with other groups of organisms. Gunawardene *et al.* (2007), mentioned in their study about a count of 132 mammal species habituated in the Western Ghats. According to the author, increased habitat loss and fragmentation of forest induced the threat of endemic species. Several endemic species like lion-tailed macaque (*Macaca silenus*), Malabar civet (*Viverra civettina*), Nilgiri tahr (*Hemitragus hylocrius*), Red slender loris (*Loris tardigradus*) are facing a high level of threat and they are categorized in to 'vulnerable' and 'endangered' categories. Family Chiroptera is representing the largest number of mammal species in Western Ghats which is approximately 51 species. In second position Rodents situated with 31 species of mammals, and Carnivora, Artiodactyla, Primates positioned in the list (Nameer, 2015). In Western Ghats region, a huge variety of endemic mammal species are habituated namely *Sunucus dayi, Anathana ellioti, Macaca silenus, Trachypitheus johnii, Semnopithecus hypoleucos, Martes gwatkinsii, Viverra civettina, Paradoxurus jerdoni, Nilgiritragus hylocrius, Funambulus tristriatus, Ratufa indica,* and *Mus famulusI* (Das & Parida, 2016). All the endemic species are facing a high rate of threat to extinction. There are several causes and influences that are inducing the threat of wild animals. Anthropogenic activity is one of the most important causes such as excessive agricultural practice in forest areas. The increasing rate of industrialisation polluted the natural condition of the forest. Western Ghats Ecology Expert Panel (WGEEP) is established by the Ministry for Environment, Forests and Climate Change (MoEF &CC) in India for the restoration of the ecological structure of Western Ghats.

CONCLUSION

The Western Ghats boast a wide range of forest types, supporting rich ecological diversity. Home to around 4000 species of flowering plants, many of which are endemic, as well as a diverse fauna with significant endemism, the region stands out for its unique biodiversity. The level of endemism varies among different species, with trees, bryophytes, odonates, land snails, reptiles, and amphibians showing higher levels of endemism compared to butterflies, birds, and mammals. The Western Ghats is inhabited by approximately 50 million people from six states and is a crucial source of water for Peninsular India, influencing the monsoon patterns. However, the region's biodiversity is under threat due to habitat pressures, leading to its classification as one of the world's most critical hotspots of biodiversity. Recognizing the need to protect and rejuvenate the Western Ghats' ecology while ensuring sustainable development, the Ministry of Environment, Forests and Climate Change established the Western Ghats Ecology Expert Panel. To better understand the evolutionary history of the region's biota, there is a need for more comparative studies between India and Sri Lanka focusing on equivalent vegetation types and taxa.

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