

Vegetation Types and Floristic Composition of the Buffer Zone of Silent Valley National Park, Palakkad, Kerala, India

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DOI: 10.18811/ijpen.v12i01.10

ABSTRACT

The Silent Valley National Park, located in Palakkad district in the Southern Western Ghats of Kerala state, is recognized as a biodiversity hotspot in India. To ensure the conservation of the National Park, an additional 148 km² of forest land has been designated as a buffer zone. The study, carried out from 2019 to 2024, aimed to identify and assess plant species diversity within the buffer zone of Silent Valley National Park. The natural forests within the buffer zone comprise various vegetation types, including West Coast Evergreen forests, West Coast Semi-evergreen forests, South Indian moist deciduous forests, South Indian dry deciduous forest, Southern montane wet temperate forests, Grasslands, and Riparian vegetation. The buffer zone is drained by two significant rivers, namely the Bhavani and Kunthipuzha. The present work reports 1,141 plant species, including 16 subspecies and 21 varieties from 680 genera, classified into 143 families, along with 2 gymnosperms. The enumeration has led to the identification of 101 edible plant species, 276 species with potential ornamental values, 168 endemic species, and 76 threatened species as per IUCN categories and criteria. The recorded plant species are grouped into 316 trees, 189 shrubs, 169 climbers, and 467 herbaceous species.

Highlights:

- The buffer zone of Silent Valley National Park is home to 1,141 plant species, including 168 endemic species and 76 threatened species as per IUCN.
- The buffer zone comprises various vegetation types, including West Coast Tropical evergreen forests, West Coast Semi-evergreen forests, South Indian moist deciduous forests, South Indian dry deciduous forest, Southern montane wet temperate forests, Grasslands, and Riparian vegetation.

Keywords: Economic plants, Endemic, Floristic composition, Forest types, Silent Valley Buffer Zone, Threatened plants

International Journal of Plant and Environment (2026);

ISSN: 2454-1117 (Print), 2455-202X (Online)

INTRODUCTION

The Western Ghats are recognized as a significant biodiversity hotspot in India, characterized by a rich array of biological diversity attributed to its varied habitats and climatic conditions (Venkataraman and Sivaperuman, 2018). Forest Silent Valley stands out as one of the last remaining undisturbed tropical rainforests in Peninsular India (Manoharan *et al.*, 1999). It was declared a National Park in 1984 and exemplifies the diverse forms of life on Earth, and serves as a rare sanctuary of natural rainforests. The Silent Valley National Park has a core area of 89.52 km², and it is free from human disturbance. To enhance the protection of the National Park, an additional 148 km² of forested land around the National Park was designated as a buffer zone in November 2009, as per the Government of Kerala, GO(MS) No. 36/07/F and WLD, dated 11.06.2007.

The core area of Silent Valley supports nearly 1,000 species of angiosperms, three species of gymnosperms, 100 species of pteridophytes, 210 species of bryophytes, 230 species of lichens, 110 species of fungi, and 140 species of algae. The National Park was notable for its high number of endemic and threatened species (Balaji *et al.*, 2024). The Silent Valley serves as a vital gene bank within the larger Nilgiri Biosphere Reserve, effectively safeguarding the rich biodiversity of the Western Ghats. The core zone of Silent Valley has been the subject of extensive research on its fauna, ecology, hydrology, pollution levels, palaeontology, and geology (Manoharan *et al.*, 1999). Several tribal communities reside in the buffer zone areas of the park. An ethno-botanical study was carried out by Ramesh

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How to cite this article: Balaji R, Prasanna R, Arunkumar S, Kunhikannan C. (2026). Vegetation Types and Floristic Composition of the Buffer Zone of Silent Valley National Park, Palakkad, Kerala, India. *International Journal of Plant and Environment*. 12(1), 85-94.

Submitted: 10/09/2025 **Accepted:** 13/05/2026 **Published:** 31/05/2026

(2007) and Jayalekshmi *et al.*, (2023) in the Palakkad district which documented over 600 and 126 useful plant species, respectively, including the tribal hamlets from the buffer zone. Although earlier research has extensively described the floristic diversity of the core area of Silent Valley National Park, systematic studies focusing on vegetation structure and species composition within its buffer zone are still scarce. The buffer zone is an essential component for maintaining ecological linkages and supporting conservation efforts. The present study aims to characterize vegetation types and analyze the floristic composition of the buffer region through detailed field surveys and updated species identification. In contrast to previous investigations centered on the core forest, this study emphasizes the buffer landscape and examines variations

in species distribution across different habitats. The results contribute to a better understanding of the ecological role of the buffer zone and provide baseline information useful for future conservation planning and management.

MATERIALS AND METHODS

Study area

The Buffer zone of Silent Valley encompasses an area of 148 km² of forest land around the Silent Valley National Park. It is situated between the Silent Valley and Bhavani forest ranges of the Silent Valley forest division, located in the Palakkad district of the Southern Western Ghats in Kerala (Fig. 1). The average temperature of the region ranges from 14°C to 29°C. The area is characterized by steep hills along all sides, which make it difficult to access. The tallest peaks of the buffer zone include Meenbhani (2048 meters), Pullumala (1719 meters), and Pathibadi (1516 meters). Indigenous tribal communities residing within the buffer zone are Irulas, Kurumbas, Mudugas, and Kattunaikkars. Kunthi River originates in Silent Valley as well as Bhavani River from the Kunds of the Nilgiris, Tamil Nadu, and flows through the Silent Valley National Park and buffer zone, respectively. Both rivers run from north to south. Certain locations of the Bhavani River form the eastern boundary of the buffer zone.

METHODOLOGY

The study was carried out between 2019 and 2024 to document the plant wealth and study the different vegetation in the region. Frequent botanical explorations were conducted in the various locations such as Mukkali, Karuvara, Panthamthodu, Aruvampara, Pathibaadi, Keeripara, Vetilachola, Palippara, Verakaatuadivaram, Chindakki, Anavail, Thudukki, Thathengalam, Kelara, Galasiee, Aralikala, Perindhaan chola, Pullumala, Sirunaazhi, Kudanperukaan, Madurakarakuopu, Ambalapara, Chempatti, Karadiyodu, the buffer zone of Neelikal, Vannampara, Menisipara, Meklapara, Pothuvapadam, Karuvarakundu, Kumban, TK colony, Kallippara, Kallampara, Vellakuzhi, Forestghatti, Nilampathikattu, Thanichuvadu, Manthampotti, Thiruvizhankunnu, and Sappathu. Photographic documentation was also carried out using a Nikon-120 camera.

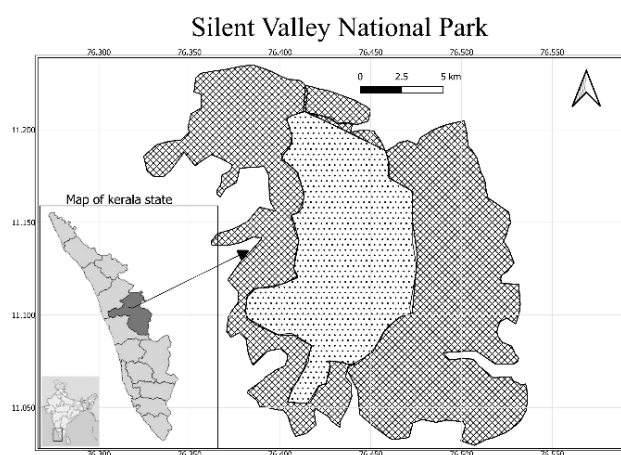


Fig.1: Map showing the core area (marked with dots), and buffer zones (marked with boxes) of Silent Valley National Park

The collected specimens were treated with a 2% mercuric chloride solution to prevent insect damage, as described by Pandey (1969). The Species identifications were done using standard floras pertaining to the study areas, such as Flora of Presidency of Madras (Gamble and Fischer, 1915-1936), The Bombay Grasses (Blatter and McCann, 1935). A field key to the trees and lianas of the evergreen forests of the Western Ghats (Pascal and Ramesh, 1987), Flora of Silent Valley (Manilal, 1988), Flora of Hassan District, Karnataka (Saldanha *et al.*, 1976), Flora of Palghat District (Vajravelu, 1990), Zingiberaceae and Costaceae of South India (Sabu, 2006), Flora of Tamil Nadu-grasses (Kabir and Nair, 2009) and Flowering Plants of Kerala, CD Rom Ver, 2 (Sasidharan, 2013). The confirmation of species identity was carried out by comparing the collected specimens with the preserved and correctly identified herbarium specimens housed at various National Herbaria such as Fischer Herbarium (FRC), IFGTB, Coimbatore; Madras Herbarium(MH), Botanical Survey of India(BSI), Southern Regional Circle (SRC), Coimbatore; Herbarium of Kerala Forest Research Institute, Peechi (KFRI) and Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode (JNTBGRI). Plants of the World Online (POWO, 2024) and International Plant Names Index (IPNI, 2026) resources were also used for updating the nomenclature changes. In the course of the study, existing literature and the expertise of staff and tribal guides were used to identify edible plant species and document wild ornamental, endemic, and threatened species in the study area. The species were arranged according to the Angiosperm Phylogeny Group IV classification system for flowering plants. The specimens collected for the present study were deposited at the Fischer Herbarium (FRC), Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore, Tamil Nadu.

RESULTS AND DISCUSSION

Explorations were conducted across multiple sites of the buffer zone and have identified 1,041 plant taxa, including 16 subspecies and 21 varieties of flowering plants, as well as 2 gymnosperms. The gymnosperms were *Gnetum edule* (Gnetaceae) and *Cycas circinalis* (Cycadaceae). The documented species were classified into 680 genera and 143 families. Among them, the Fabaceae is the most diverse family with 97 species, followed by Poaceae (71 Species) and Rubiaceae (56 species).

Vegetation

The buffer zone exhibits significant vegetation diversity, reflecting its varied climatic and topographic conditions. The area boasts a rich floral diversity, characterized by a notable percentage of endemic species. Yet another noteworthy feature of the vegetation is the preponderance of trees, with 315 tree species. The buffer zone hosts a variety of endemic and threatened plant species, including *Ampelocissus birii*, *Arenga wightii*, *Arisaema muricaudatum*, *Bulbophyllum fischeri*, *Euonymus angulatus*, *Rungia sisparensis*, *Strobilanthus dupenii*, *Typhonium bulbiferum*, and *Vanda thwaitesii*. The vegetation of the region is categorized into several types, namely West Coast Tropical Evergreen forests, West Coast Semi-evergreen forests, South Indian moist deciduous forests, South Indian dry deciduous, Southern montane wet temperate forests, Grasslands, and Riparian zones (Manoharan *et al.*, 1999; Satish and Reddy, 2016).

West coast tropical evergreen forest

This type of forest can be seen mainly in the Atti, Karuvarakundu, Manthampotti, Mukkali, Panthamthodu, Thudukki, and TK Colony areas at altitudes ranging from 550 to 1350 meters. Floristic composition of this type consists of trees in the different storeys, such as canopy, second storey, lianas, shrub layer, and herbaceous or ground vegetation. Numerous species, notably tall trees and lianas, form and densely cover the upper canopy. The species commonly found in the canopy layer include *Actinodaphne wightiana*, *Aglaia lawii*, *Antiaris toxicaria*, *Aphanamixis polystachya*, *Bischofia javanica*, *Calophyllum polyanthum*, *Canarium strictum*, *Cinnamomum malabathrum*, *Cullenia exarillata*, *Diospyros buxifolia*, *Drypetes elata*, *Dysoxylum malabaricum*, *Elaeocarpus tuberculatus*, *Hopea parviflora*, *Holigarna arnottiana*, *Hydnocarpus alpina*, *Knema attenuata*, *Mangifera indica*, *Machilus glaucescens*, *Mastixia arborea*, *Meliosma pinnata*, *Mesua ferrea*, *Palaquium ellipticum*, *Paracroton pendulus* subsp. *zeylanicus*, *Prunus zeylanica*, *Reinwardtiodendron anamalaiense*, *Toona ciliata*, *Turpinia malabarica* and *Vateria indica*. Below the top canopy layer, the second storey has medium-sized trees like *Agrostistachys borneensis*, *Elaeocarpus serratus*, *Baccaurea courtallensis*, *Canthium dicocum*, *Euonymus angulatus*, *Garcinia cambogioides* var. *cambogioides*, *G. gummi-gutta*, *Glochidion ellipticum*, *Gomphandra coriacea*, *Gordonia obtusa*, *Isonandra lanceolata*, *Litsea floribunda*, *Lepisanthes erecta*, *L. tetraphylla*, *Mallotus tetracoccus*, *Meiogyne pannosa*, *Melicope lunu-ankenda*, *Syzygium laetum*, *S. munronii*, *Trichilia connaroides* and *Vepris bilocularis*. The luxuriant lianas in the forest type are *Artabotrys zeylanicus*, *Bauhinia phoenicea*, *Derris brevipes*, *Embellia ribes*, *Kunstleria keralense*, *Mezoneuron cucullatum*, *Smythea bombaiensis*, *Sarcostigma kleinii*, and *Toddalia asiatica*. *Atalantia racemosa*, *Carissa spinarum*, *Ixora nigricans*, *Mycetia acuminata*, and *Psychotria nigra* are some of the shrubs reported in this forest. The ground vegetation showed the presence of *Alpinia malaccensis*, *Balanophora fungosa* subsp. *indica*, *Meistera acuminata*, and *M. cannicarpa*.

Holo-mycotrophic species are plants that obtain all their nutrients by associating with fungi, rather than through photosynthesis. *Epipogium roseum* and *Burmannia championii* (Fig.2a) are such species recorded in the evergreen forests of Panthamthodu and Keeripara area respectively.

West Coast semi-evergreen forest

This forest type is predominantly found in Anavai, Aruvampara, Chindakki, Karuvara, and Pothuvapadam areas at altitudes ranging from 320 to 1130 meters. Semi-evergreen forests consist of species such as *Aglaia lawii*, *Antiaris toxicaria*, *Artocarpus heterophyllus*, *A. hirsutus*, *Bischofia javanica*, *Bombax ceiba*, *Carallia brachiata*, *Chukrasia tabularis*, *Dimocarpus longan*, *Ficus nervosa*, *F. callosa*, *Holoptelea integrifolia*, *Hopea parviflora*, *Hydnocarpus alpina*, *Pajanelia longifolia*, *Prunus ceylanica*, *Schleichera oleosa*, *Terminalia bellirica*, and *Toona ciliata* at the canopy level. Below the canopy, *Acronychia pedunculata*, *Agrostistachys borneensis*, *Antidesma montanum*, *Aporosa cardiosperma*, *Diospyros bourdillonii*, *Drypetes oblongifolia*, *Callicarpa tomentosa*, *Flacourtia indica*, *Mallotus philippensis*, *Meiogyne ramarowii*, *Mimusops elengi*, *Olea dioica*, *Oroxylum indicum*, *Sapindus trifolius*, *Vitex altissima*, and *Xanthophyllum*

flavescens are present. Important lianas found in this type of forest are *Ancistrocladus heyneanus*, *Calamus pseudotenius*, *Derris brevipes*, *Entada rheedei*, *Erycibe paniculata*, *Mezoneuron cucullatum*, *Olax imbricata*, *Sarcostigma kleinii*, *Senegalia rugata*, *Strychnos wallichiana*, and major shrubs represented in the layer were *Ixora brachiata*, *Justicia santapani*, *Leea indica*, and *Murraya paniculata*.

South Indian moist deciduous forests

This forest type was noticed mainly in Karuvara, Karuvarakundu, Neelikal buffer, Pothuvapadam, TK colony, Thathengalam, and Thiruvizhankunnu areas at altitudes ranging from 250 to 815 meters. The species composition in the canopy layer of moist deciduous forests includes *Albizia odoratissima*, *A. procera*, *Alstonia scholaris*, *Bombax ceiba*, *Bridelia retusa*, *Dillenia pentagyna*, *Gmelina arborea*, *Grewia tiliifolia*, *Haldina cordifolia*, *Hymenodictyon obovatum*, *Lagerstroemia microcarpa*, *Lannea coromandelica*, *Melia Dubai*, *Pterocarpus marsupium*, *Radermachera xylocarpa*, *Stereopermum colais*, *Terminalia paniculata*, and *Xylia xylocarpa*. The next stratum of the forest consists of *Bombax insigne*, *Cochlospermum religiosum*, *Dalbergia sissooides*, *Holarrhena pubescens*, *Tabernaemontana alternifolia*, *Tamilnadia uliginosa*, *Wrightia tinctoria*, and *Ziziphus rugosa*. There were a few lianas in the forest, namely *Bridelia scandens*, *Getonia floribunda*, *Moullava spicata*, and *Olax imbricata*. Shrubby layer consists of *Abutilon persicum*, *Canthium travancoricum*, *Cipadessa baccifera*, *Dalbergia volubilis*, *Flemingia macrophylla*, *F. strobilifera*, *Grewia nervosa*, and *Helicteres isora*.

Some parasitic plants *Dendrophthoe falcata*, *Helicanthes elastica*, *Helixanthera wallichiana*, *Macrosolen capitellatus*, *Macrosolen parasiticus*, *Scurrula parasitica*, *Taxillus tomentosus*, and *Viscum angulatum* were frequently noticed on the trees.

South Indian Dry Deciduous forests

This type of forest occurs mainly at the entrance regions of the buffer zone at altitudes ranging from 110 to 600 meters. The vegetation is dominated by tree species such as *Albizia odoratissima*, *Bauhinia racemosa*, *Bombax ceiba*, *Butea monosperma*, *Dalbergia lanceolaria*, *Dalbergia sissooides*, *Falconeria insignis*, *Ficus racemosa*, *Flacourtia indica*, *Grewia tiliifolia*, *Holoptelea integrifolia*, *Mitragyna parvifolia*, *Pterocarpus marsupium*, *Sapindus trifolius*, *Schleichera oleosa*, *Sterculia guttata*, *S. urens*, *Tectona grandis*, *Terminalia anogeissiana*, *Wrightia tinctoria*, and *Xylia xylocarpa*. Common climbers found twining around these trees include *Combretum latifolium*, *Dalbergia horrida*, *Dinochloa scandens*, and *Spatholobus parviflorus*.

Southern montane wet temperate forest

This forest type can be seen in Meenbhani, Pathibadi, and Vannampara areas at altitudes ranging from 1140 to 2048 meters. Species documented in the canopy layer of Southern montane wet temperate forests were *Actinodaphne bourdillonii*, *Cinnamomum sulphuratum*, *Cleyera japonica*, *Diospyros saldanhae*, *Euonymus crenulatus*, *Euonymus indica*, *Eurya japonica*, *Polyspora obtusa*, *Ilex denticulata*, *Ilex gardneriana*, *Magnolia champaca*, *Pittosporum neelgherrense*, and *Symplocos acuminata*. The shrub and herbaceous species of this forest type include *Fagraea ceilanica*, *Maesa indica*, *Peperomia tetraphylla*,

Rungia sisparensis, and *Syzygium lanceolatum*, with a profusion of *Ageratina adenophora*.

Grasslands

Grasslands were found in the regions of Keeripara, Meenbhani, Pullumala, Vannampara (Fig. 2b), and Thudukki areas. The grasslands located in the buffer zone were characterized by a diverse array of species, including *Arundinella leptochola*, *Chrysopogon aciculatus*, *Cymbopogon caesius*, *C. citratus*, *C. flexuosus*, and *Themeda triandra*. Additionally, various herbs such as *Leucas prostrata*, *Osbeckia aspera*, *O. brachystemon*, and *Pogostemon mollis*.

Drosera burmanni and *D. peltata*, belonging to the Droseraceae family, along with *Utricularia caerulea*, *U. graminifolia*, *U. scandens*, and *U. striatula* from the Lentibulariaceae family, are the dominant herbaceous plants that thrive in moist rocky environments and grasslands. These species adapted to capture and digest the insects and the microscopic organisms.

Riparian vegetation

Tributaries of the Kunthi and Bhavani rivers formed their banks of streamlets, and resultant marshy regions created aquatic habitats. In this environment, *Homonoia riparia* was frequently found in both rivers, while *Dalzellia ceylanica*, *Polypleurum wallichii* (Fig. 3a), and *P. stylosum* thrive exclusively in fast-flowing streams. Additionally, various families such as Araceae, Commelinaceae, Cyperaceae, Eriocaulaceae, Gentianaceae, Lentibulariaceae, Onagraceae, Scrophulariaceae, Poaceae, and Polygonaceae were commonly observed in marshy areas.

The buffer zone has large rocky hillocks with several plant species located on such habitats, such as *Boucerosia umbellata*, *Careya arborea*, *Dalbergia lanceolaria*, *Heptapleurum capitatum*, *Sapium insigne*, *Sapindus trifoliatum*, *Sterculia colorata*, *S. urens*, *Terminalia anogeissiana*, and *Xylia xylocarpa*. A few species,

such as *Dendrobium barbatulum*, *Bulbophyllum sterile*, *Impatiens acaulis*, *Procris crenata*, and *Tripogon bromoides* were solely found on the rocky surface.

Plantations

The buffer zone has several plantations that are mainly distributed in Anavai, Chindakki, Karuvara, Mukkali, Panthamthodu, and Pothuvapadam areas. The notable species in these plantation areas including *Acacia auriculiformis*, *Coffea arabica*, *Eucalyptus grandis*, and *Tectona grandis*. In the buffer zone, numerous private estates existed, which were used to cultivate economic plants, including *Anacardium occidentale*, *Areca catechu*, *Cocos nucifera*, *Elettaria cardamomum*, *Ficus auriculata*, *Garcinia gummi-gutta*, *Hevea brasiliensis*, *Musa x paradisiaca* (Nendran variety), *Myristica fragrans*, *Nephelium lappaceum*, *Piper nigrum*, and *Syzygium aromaticum*.

Invasive species showed a significant threat to biodiversity (Sajeev, 2012). Various invasive plants such as *Ageratina adenophora*, *Ageratum conyzoides*, *Alternanthera bettzickiana*, *A. brasiliana*, *Amaranthus spinosus*, *Cestrum nocturnum*, *Centratherum intermedium*, *Centrosema molle*, *Chromolaena odorata*, *Clidemia hirta*, *Ipomoea hederifolia*, *I. purpurea*, *Lantana camara*, *Ludwigia peruviana*, *Merremia vitifolia*, *Mikania micrantha*, *Mucuna bracteata*, *Parthenium hysterophorus*, *Pennisetum pedicellatum*, *Senna hirsuta* and *Synedrella nodiflora* contributed on the decline of native species and adversely impacted different habitats in the buffer zone.

Endemic plants

The presence of endemic plant species indicates the ecological stability, environmental quality, rich biodiversity, and conservation significance of a particular region. Endemic species are important indicators for evaluating the conservation status of



Fig.2: (a): Holo-mycotrophic species of *Burmannia championii* Thwaites, and (b). Grassland of Vannampara, Silent Valley Buffer zone.



Fig.3: (a). Flowering thallus of *Polypleurum wallichii* (R.Br. ex-Griff.) Warm., (b). An endemic tree species -*Cullenia exarillata* A. Robyns., and (c). Endangered orchid species -*Vanda thwaitesii* Hook.f.

Table 1: Wild edible plants documented in the study area from local tribes

S.No.	Plant Name	Family	Part
1	<i>Asystasia gangetica</i> (L.) T.Anderson	Acanthaceae	Leaves
2	<i>Mangifera indica</i> L.	Anacardiaceae	Fruit
3	<i>Spondias pinnata</i> (L.f.) Kurz	Anacardiaceae	Fruit
4	<i>Annona glabra</i> L.	Annonaceae	Fruit
5	<i>Annona squamosa</i> L.	Annonaceae	Fruit
6	<i>Annona reticulata</i> L.	Annonaceae	Fruit
7	<i>Centella asiatica</i> (L.) Urb.	Apiaceae	Leaves
8	<i>Eryngium foetidum</i> L.	Apiaceae	Leaves
9	<i>Amorphophallus bulbifer</i> (Schott) Blume	Araceae	Tuber
10	<i>Colocasia esculenta</i> (L.) Schott	Araceae	Leaves and Fruit
11	<i>Berberis napaulensis</i> var. <i>napaulensis</i>	Berberidaceae	Fruit
12	<i>Cordia dichotoma</i> G.Forst.	Boraginaceae	Fruit
13	<i>Garuga pinnata</i> Roxb.	Burseraceae	Fruit
14	<i>Opuntia ficus-indica</i> (L.) Mill.	Cactaceae	Fruit
15	<i>Celtis tetrandra</i> Roxb.	Cannabaceae	Fruit
16	<i>Trema orientale</i> (L.) Blume	Cannabaceae	Fruit
17	<i>Carica papaya</i> L.	Caricaceae	Fruit
18	<i>Garcinia cambogioides</i> var. <i>cambogioides</i>	Clusiaceae	Fruit
19	<i>Grcinia gummi-gutta</i> (L.) Roxb.	Clusiaceae	Fruit
20	<i>Garcinia mangostana</i> L.	Clusiaceae	Fruit
21	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	Seed
22	<i>Alangium salviifolium</i> (L.f.) Wangerin	Cornaceae	Fruit
23	<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	Leaves and Fruit
24	<i>Cucumis silentvalleyi</i> (Manilal, T.Sabu & P.Mathew) Ghebret. & Thulin	Cucurbitaceae	Fruit
25	<i>Momordica charantia</i> L.	Cucurbitaceae	Fruit
26	<i>Dioscorea oppositifolia</i> L.	Dioscoreaceae	Tuber
27	<i>Dioscorea tomentosa</i> Koenig ex Spreng.	Dioscoreaceae	Tuber
28	<i>Dioscorea bulbifera</i> L.	Dioscoreaceae	Tuber
29	<i>Diospyros bourdillonii</i> Brandis	Ebenaceae	Fruit
30	<i>Diospyros candolleana</i> Wight	Ebenaceae	Fruit
31	<i>Elaeagnus conferta</i> Roxb.	Elaeagnaceae	Fruit
32	<i>Elaeagnus indica</i> Servett.	Elaeagnaceae	Fruit
33	<i>Elaeocarpus variabilis</i> Zmarzty	Elaeocarpaceae	Fruit
34	<i>Manihot carthagensis</i> subsp. <i>Glaziovii</i> (Mull.Arg.) Allem	Euphorbiaceae	Tuber
35	<i>Canavalia ensiformis</i> (L.) DC.	Fabaceae	Fruit
36	<i>Derris brevipes</i> (Benth.) Baker	Fabaceae	Seed
37	<i>Flemingia macrophylla</i> (Willd.) Kuntze ex Merr.	Fabaceae	Seed
38	<i>Lablab purpureus</i> (L.) Sweet	Fabaceae	Fruit
39	<i>Mucuna pruriens</i> (L.) DC.	Fabaceae	Seed

cont...

40	<i>Pueraria tuberosa</i> (Roxb. ex Willd.) DC.	Fabaceae	Tuber
49	<i>Xylia xylocarpa</i> (Roxb.) W.Theob.	Fabaceae	Seed
50	<i>Dolichos trilobus</i> L.	Fabaceae	Seed
51	<i>Vigna radiata</i> Roxb.	Fabaceae	Seed
52	<i>Curculigo orchiioides</i> Gaertn.	Hypoxidaceae	Tuber
53	<i>Mappia nimmoniana</i> (J.Graham) Byng & Stull	Icacinaeae	Fruit
54	<i>Sarcostigma kleinii</i> Wight & Arn.	Icacinaeae	Fruit
55	<i>Gmelina arborea</i> Roxb. ex Sm.	Lamiaceae	Fruit
56	<i>Careya arborea</i> Roxb.	Lecythidaceae	Fruit
57	<i>Memecylon edule</i> var. <i>edule</i>	Melastomataceae	Fruit
58	<i>Memecylon umbellatum</i> Burm.f.	Melastomataceae	Fruit
59	<i>Aglaia edulis</i> (Roxb.) Wall.	Meliaceae	Fruit
60	<i>Aglaia elaeagnoidea</i> (A.Juss.) Benth.	Meliaceae	Fruit
61	<i>Cipadessa baccifera</i> (Roth) Miq.	Meliaceae	Fruit
62	<i>Artocarpus lacucha</i> Buch. Ham.	Moraceae	Fruit
63	<i>Artocarpus zeylanicus</i> (F.M.Jarrett) E.M.Gardner & Zerega	Moraceae	Fruit
64	<i>Ficus auriculata</i> Lour.	Moraceae	Fruit
65	<i>Ficus amplissima</i> Sm.	Moraceae	Fruit
66	<i>Muntingia calabura</i> L.	Muntingiaceae	Fruit
67	<i>Musa rosea</i> Baker	Musaceae	Fruit
68	<i>Psidium guajava</i> L.	Myrtaceae	Fruit
69	<i>Rhodomyrtus tomentosa</i> (Aiton) Hassk.	Myrtaceae	Fruit
70	<i>Syzygium lanceolatum</i> (Lam.) Wight & Arn.	Myrtaceae	Fruit
71	<i>Averrhoa bilimbi</i> L.	Oxalidaceae	Fruit
72	<i>Oxalis corniculata</i> L.	Oxalidaceae	Leaves
73	<i>Oxalis debilis</i> Kunth	Oxalidaceae	Leaves
74	<i>Benstonea thwaitesii</i> (Martelli) Callm. & Buerki	Pandanaceae	Fruit
75	<i>Passiflora edulis</i> Sims	Passifloraceae	Fruit
76	<i>Antidesma montanum</i> Blume	Phyllanthaceae	Fruit
77	<i>Aporosa cardiosperma</i> (Gaertn.) Merr.	Phyllanthaceae	Fruit
78	<i>Baccaurea courtallensis</i> (Wight) Mull. Arg.	Phyllanthaceae	Leaves and Fruit
79	<i>Bischofia javanica</i> Blume	Phyllanthaceae	Seed
80	<i>Breynia androgyna</i> (L.) Chakrab. & N.P.Balakr.	Phyllanthaceae	Leaves and Fruit
81	<i>Bridelia retusa</i> (L.) A.Juss.	Phyllanthaceae	Fruit
82	<i>Bridelia stipularis</i> (L.) Blume	Phyllanthaceae	Fruit
83	<i>Flueggea leucopyrus</i> Willd.	Phyllanthaceae	Fruit
84	<i>Flueggea virosa</i> (Roxb. ex Willd.) Royle	Phyllanthaceae	Fruit
85	<i>Phyllanthus emblica</i> L.	Phyllanthaceae	Fruit
86	<i>Piper longum</i> L.	Piperaceae	Fruit
87	<i>Scoparia dulcis</i> L.	Plantaginaceae	Leaves
88	<i>Embelia ribes</i> Burm.f.	Primulaceae	Fruit

Cont...

89	<i>Maesa indica</i> (Roxb.) A. DC.	Primulaceae	Fruit
90	<i>Carallia brachiata</i> (Lour.) Merr.	Rhizophoraceae	Fruit
91	<i>Aegle marmelos</i> (L.) Correa	Rutaceae	Fruit
92	<i>Atalantia monophylla</i> DC.	Rutaceae	Fruit
93	<i>Clausena indica</i> (Dalzell) Oliv.	Rutaceae	Fruit
94	<i>Glycosmis mauritiana</i> (Lam.) Tanaka	Rutaceae	Fruit
95	<i>Glycosmis pentaphylla</i> (Retz.) DC.	Rutaceae	Fruit
96	<i>Flacourtia indica</i> (Burm.f.) Merr.	Salicaceae	Fruit
97	<i>Scolopia crenata</i> (Wight & Arn.) Clos	Salicaceae	Fruit
98	<i>Allophylus cobbe</i> (L.) Forsyth f.	Sapindaceae	Fruit
99	<i>Cardiospermum halicacabum</i> L.	Sapindaceae	Leaves
100	<i>Dimocarpus longan</i> Lour.	Sapindaceae	Fruit
101	<i>Nephelium lappaceum</i> L.	Sapindaceae	Fruit
102	<i>Schleichera oleosa</i> (Lour.) Oken	Sapindaceae	Fruit
103	<i>Physalis angulata</i> L.	Solanaceae	Fruit
104	<i>Solanum nigrum</i> L.	Solanaceae	Leaves and Fruit
105	<i>Capsicum frutescens</i> L.	Solanaceae	Fruit
106	<i>Ampelocissus latifolia</i> (Roxb.) Planch.	Vitaceae	Fruit
107	<i>Cayratia mollissima</i> (Wall.) Gagnep.	Vitaceae	Fruit
108	<i>Cayratia pedata</i> (Lam.) Gagnep.	Vitaceae	Fruit
109	<i>Cissus discolor</i> Blume	Vitaceae	Fruit

threatened plants. To assess endemism in the present study area, the collected species were grouped based on their geographic distribution. A total of 168 plant species were identified as endemics (Manilal, 1988; Vajravelu, 1990; Manoharan *et al.*, 1999; POWO, 2024). 25 species are endemic to Peninsular India, including *Alstonia venenata*, *Baccaurea courtallensis*, *Diospyros candolleana*, and *Impatiens minor*. Whereas Fifty-four species are endemic to the Western Ghats, including *Hopea parviflora*, *Litsea stocksii*, *Meiogyne pannosa*, *Syzygium munronii*, *Typhonium bulbiferum*, and *Zingiber neesatum*. There are 83 species that are endemic to the Southern Western Ghats, e.g., *Arisaema muricaudatum*, *Cullenia exarillata* (Fig. 3b), *Holigarna arnottiana*, *H. beddomei*, *Kunstleria keralensis*, *Rungia sisparensis*, *Salacia beddomei*, *Strobilanthes virendrakumariana* and *Syzygium mundagam*. *Pterospermum rubiginosum* is endemic to the Southern Western Ghats.

Threatened species

The threatened plant species recorded in the buffer zone are *Curcuma vama* (Sabu, 2019), *Dipterocarpus bourdillonii* (Deepu *et al.*, 2021) and *Ilex gardneriana* (Oldfield, 2020) is Critically Endangered (EN). 13 species are endangered (EN) such as *Canarium strictum* (Amitha Bachan and Devika, 2024a), *Cinnamomum perrottetii* (De Kok and Geethakumary, 2020a), *C. wightii* (Saha *et al.*, 2015), *Cycas circinalis* (Bosenberg, 2023), *Dysoxylum malabaricum* (Ved *et al.*, 2015a), *Ficus beddomei* (Amitha Bachan and Devika, 2023a), *Hopea glabra* (Deepu *et al.*, 2023a), *H. racophloea* (Deepu *et al.*, 2023b), *Prunus ceylanica*

(WCMC, 1998a), *Psychotria Globicephala* (WCMC, 1998b), *P. macrocarpa* (WCMC, 1998c), *Sophora wightii* (WCMC, 1998d), *Syzygium calophyllifolium* (Amitha Bachan and Devika, 2023b) and *Vanda thwaitesii* (Decruse, 2023) (Fig. 3c). 32 are Vulnerable (VU) species, such as *Actinodaphne lawsonii* (De Kok, 2022), *Casearia wynadensis* (Amitha Bachan and Devika, 2025), *Dalbergia sissooides* (Ahmedullah, 2022), and *Diospyros candolleana* (Ved *et al.*, 2015b). 17 species come under the Near Threatened (NR) category, such as *Calophyllum polyanthum* (Amitha Bachan and Devika, 2024b), *Cullenia exarillata* (Gole, 2024), *Litsea floribunda* (De Kok and Geethakumary, 2020b), and *Nothopogon castaneifolia* (Watve and Gole, 2025). 11 species are listed as Data Deficient, such as *Dimocarpus longan* (Barstow, 2022) and *Hedychium coronarium* (Olander, 2020) as per the IUCN categories and criteria.

Economically Potential Plants

Wild edible plants

Wild edible species are the plants which are not cultivated or domesticated but found in their natural habitats in the forest that are utilized as food in different forms (Sundriyal and Sundriyal, 2004). The survey recorded 101 species of wild edible plants within the study area, based on information gathered from the local tribe (Table.1). The species were categorized as wild leafy vegetables, fruits, seeds, and tuber crops. Most of the species were cooked and eaten. Some of the examples for these species are: Edible leaves (*Asystasia gangetica*, *Centella asiatica*,

Colocasia esculenta, and *Breynia androgyna*), Fruits (*Baccaurea courtallensis*, *Berberis napaulensis* var. *napaulensis*, *Cordia dichotoma*, *Cucumis silentvalleyi*, and *Spondias pinnata*), Seeds (*Bischofia javanica*, *Cajanus albicans*, and *Flemingia macrophylla*), and Tubers (*Amorphophallus bulbifer*, *Dioscorea oppositifolia*, *Dioscorea bulbifera*, and *Pueraria tuberosa*).

Agricultural crops

The indigenous tribal communities, such as Irulas, Kurumbas, Mudugas, Kattunaikkars, and other local people, were engaged in the cultivation of various plants to meet their daily requirements, which include *Amaranthus viridis*, *Cajanus cajan*, *Curcubita maxima*, *Eleusine coracana*, *Ipomoea batatas*, *Lablab purpureus*, *Lycopersicon esculentum*, *Manihot esculenta*, *Piper nigrum*, *Solanum nigrum*, and *Zea mays*. The fruit-bearing trees and climbers such as *Mangifera indica*, *Artocarpus heterophyllus*, *Artocarpus hirsutus*, *Carica papaya*, *Musa x paradisiaca* (Nendran variety), and *Passiflora edulis* were commonly grown in the area.

Wild ornamental species

The present study documented 276 species as wild ornamental plants. Notable examples include *Barleria courtallica*, *Begonia integrifolia*, *Callicarpa tomentosa*, *Cissus discolor*, *Clerodendrum paniculatum*, *Clematis gouriana*, *Chionanthus ramiflorus*, *Cochlospermum religiosum*, *Eulophia zollingeri*, *Firmiana colorata*, *Globba sessiliflora*, *Ixora cuneifolia*, *Jasminum flexile*, *Justicia santapaui*, *Lagerstroemia speciosa*, *Magnolia champaca*, *Memecylon umbellatum*, *Mussaenda frondosa*, *Passiflora subpeltata*, *Pavetta tomentosa*, *Syzygium mundagam*, *Tamilnadia uliginosa*, *Thunbergia alata*, *T. fragrans*, and *T. mysorensis*.

CONCLUSION

Silent Valley is recognized as one of the most affluent tropical rainforests in India. The geographical isolation afforded by the surrounding elevated ridges, hills, and escarpments has facilitated the evolution of these forests into a significant biodiversity reserve. This research aimed to record the plant diversity in the little-explored buffer zone of Silent Valley National Park, and the study was conducted in 40 locations and identified a total of 1,141 taxa (including 16 subspecies and 21 varieties) belonging to 680 genera and spreading over 143 families, along with two gymnosperms. The findings revealed 101 edible plant species, 276 species with potential ornamental value, 168 endemic species, and 76 threatened plant species classified under various categories according to the IUCN. The documented plant species were categorized into 316 trees, 189 shrubs, 169 climbers, and 467 herbaceous species.

Documentation of plant diversity is very important as it gives the status of the plants, endemism. Accordingly, the management plan of the protected areas can be designed to have specific conservation measures for different categories of species. The buffer zone serves as a natural barrier for the core zone of the National Park. To maintain the integrity of the core zone's biodiversity, it is essential to safeguard the buffer zone from degradation. Various threats, including human activities and wildfires, pose risks to the buffer zone's biodiversity. These areas experience a higher frequency of forest fires due to human activity. The prevalence of invasive species is notably higher in

the regions subjected to frequent anthropogenic disturbances. To ensure comprehensive protection of biodiversity and its endemic species, the Kerala government is working towards designating the buffer zone as a wildlife sanctuary, which can enhance the protection of both the buffer and core zones of Silent Valley National Park.

ACKNOWLEDGEMENT

We express our profound gratitude to the Kerala Forest and Wildlife Department for their financial assistance in conducting this study. Our thanks are also due to Dr. Mohit Gera, IFS, Dr. S. Murugesan, and Sh. S. Senthilkumar, IFS, who served as Director, as well as Dr. R. Yasodha, Group Co-coordinator (Research) at the Institute of Forest Genetics and Tree Breeding (IFGTB). The successful completion of this work was made possible through the invaluable support of Forest officials, including the Wildlife Warden, Assistant Wildlife Warden, Deputy Range Officers, Foresters, and Forest Guards of Silent Valley National Park, to whom we extend our hearty thanks. Additionally, we acknowledge the timely assistance provided by the EDC watchers of Silent Valley and Bhavani Range during the fieldwork. We are also grateful to the Head, Scientists, and all members of the FECC division for their wholehearted support.

AUTHORS CONTRIBUTION

R. Balaji designed the study, collected and identified the specimens, conducted the field survey, analysed and interpreted the data, and drafted the manuscript. R. Prasanna and S. Arunkumar assisted in the field survey and herbarium preparation. Dr. C. Kunhikannan supervised the entire study and reviewed the manuscript for necessary corrections.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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