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Assessment of Threatened tree Species of the Nilgiri Biosphere Reserve (NBR), Southern Western Ghats, India

The Western Ghats is the world's second-most significant refuge for species at risk. The Nilgiri Biosphere Reserve, a part of the southern Western Ghats region is one of the richest biogeographic regions in the Indian subcontinent. The present study documented a total of 68 taxa belonging to 50 genera and 35 families. Certain threatened factors, like overexploitation of natural resources and other anthropogenic activities, adversely affect the existing ecosystem and lead to the rarity of many species in the future. Therefore, the study suggests that there is a need to protect ecologically sensitive forest patches due to the occurrence of many endemic and threatened species in this region.

Key words : Conservation status, Economic importance, Protected areas, Environmental sustainability.

Safeguarding over-exploited species is not a choice; it's a necessity for our future.

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Introduction

Trees are the backbone of forests and play an important role in the structural and functional dynamics of forest stands and provide various ecosystem services (Tadwalkar *et al*., 2020). India is home to a rich diversity of plant species and is recognized as one of the world's most biodiverse countries. Nilgiri Biosphere Reserve (NBR), boasts nearly 18,000 species of flowering plants**,** with one-third of them being endemic to the Western Ghats. The altitude ranges from 250 to 2,670 m. and the region is home to approximately 1,600 plant species across 500 genera**,** including trees, shrubs, climbers, and herbs**.** The Western Ghats are considered one of the world's "hottest biodiversity hotspots" and are among the 36 global biodiversity hotspots. Additionally, they have been designated as a UNESCO World Heritage site (Sarvalingam and Rajendran, 2016).

A few research reports on threatened flowering plants of the Western Ghats in recent decades. As far as the threatened woody plant species of the southern Western Ghats are concerned, no comprehensive documentation has been taken up in the past. Therefore, there is an urgent need to protect arborous species. Nowadays, anthropogenic activities in such forest habitats are increasing significantly. The southern Western Ghats are located close to human settlements. Considering the above facets, the present investigation was undertaken to survey and document the threatened tree species of the Nilgiri Biosphere Reserve, and southern Western Ghats India, which have been included under the IUCN threatened category due to human pressure.

Material and Methods

Study area

The Nilgiris Biosphere Reserve (NBR) is a part of Western Ghats (WG) and it is home to an incredibly diverse flora and fauna. It spans an area of 5,520 km², located between 10.750°N – 12.000°N and 76.000°E–77.250°E, across Kerala, Karnataka, and Tamil Nadu States. The altitude

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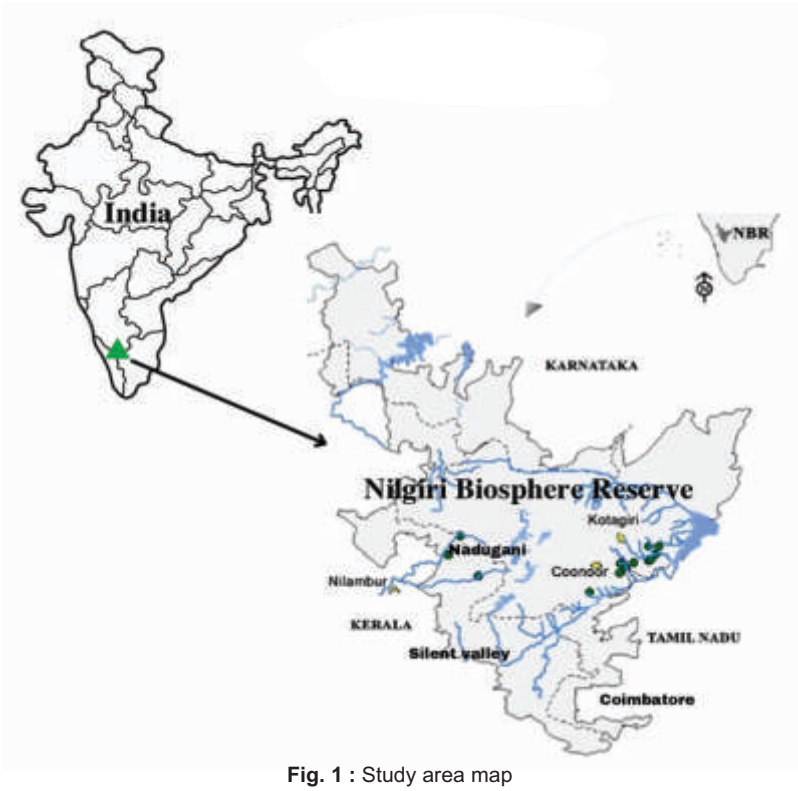

Fig. 1 : Study area map

ranges from 250 to 2,670 m along the NBR. The region receives 2000–7000 mm rainfall annually. The WG is one of the eight hottest hot spots of the world, with many endemic and threatened plants.

Sholas (evergreen forest), semi-evergreen forest, and dry and moist deciduous forests presenting many endemic, threatened and rare plant and animal species occur in the Nilgiris Biosphere Reserve area (Fig. 1). These forests occur in Nadugani, Devala, Pandalur, Gudalur, Kotagiri, AValanchi, Coimbatore (Tamil Nadu), Anaikatti, Attapadi, Sholaiyur, Kottathurai and Mukkali (Kerala). They are located in the small interconnected hills, approximately 600 m, within the mountain zone that reaches around 2100 m.

Methodology

Field trips were made at regular intervals to the study region during the period from September 2021 to October 2023. The collected species were identified with the help of various regional and local floras (Nayar and Sastry, 1987; Matthew, 1983) and were also cross-referenced with previous research articles. The botanical name was verified using the online version of Plants of the World (POWO) (https://powo.science.kew.org/), IUCN Red List (https://iucnredlist.org/), GBIF (https://www.gbif.org/), the Biodiversity of India, the Nomenclature of Collected Plant Species (IUCN Revised), the updated portal of observed plant species, and the latest research papers from online resources and databases.

Result and Discussion

The present study documented a total of 67 threatened taxa belonging to 51 genera in 35 families (Table 1). Of the 35 plant families, Fabaceae represented seven species, Ebenaceae five species, Rutaceae and Meliaceae four species each, Dipterocarpaceae, Combretaceae, Cluciaceae and Achariaceae each three species and the rest of the families each represented less than three species. Out of the 67 species, 29 are endemic to the southern Western Ghats of India. Among the woody plants, 38% are categorized as Vulnerable and are at risk of becoming Critically Endangered in the future due to deforestation; 35% of the species are considered Endangered, 11% Near Threatened, 9% Least concern and 7% Critically Endangered in the Nilgiri Biosphere Reserve.

Previously considered nearly extinct, *Madhuca bourdillonii* (Gamble) Lam., was later rediscovered in small populations within its native range in the Western Ghats, southern Palghat Gap. In this study, the presence of *M. bourdillonii* was recorded in the southern Western Ghats within the Nilgiris Biosphere Reserve. In the study area, many species listed in Table 1 are over-exploited for medicinal and non-medicinal uses. The species recorded in this study are subjected to various human activities such as deforestation, illegal logging, mining, and tourism, and also to colonization by invasive species.

Table 1: List of threatened tree species of the present study area.

S. No.	Botanical name	Family	Endemic	Threatened status	Reference
1	*Hydnocarpus alphina* Wight	Achariaceae	E	EN	Ray and Saini (2022)
2	*Hydnocarpus macrocarpa* (Bedd.) Warb.		E	VU	Pradhan *et al*. (2020)
3	*Hydnocarpus pentandrus* (Buch.-Ham.) Oken		E	VU	Jansirani (2016)
4	*Alangium salviifolium* L.	Alanginaceae	-	EN	Ayyanar *et al*. (2014)
5	*Polyalthia rufescens* Hook.f.& Thomson	Annonaceae	-	EN	Anjana (2020)
6	*Toxocarpus beddomei* Gamble	Apocynaceae	E	EN	Narasimhan and Irwin (2021)
7	*Arenga wightii* Griff.	Arecaceae	E	VU	Sarvalingam and Rajendran (2016)
8	*Pinanga dicksonii* (Roxb.) Blume		E	VU	Nair and Henry (1983)
9	*Thottea siliquosa* (Lam.) Ding Hou.	Aristolochiaceae	-	VU	Karuppusamy (2018)
10	*Jacaranda mimosifolia* D.Don	Bignoniaceae	-	VU	Hills (2020)
11	*Oroxylum indicum* (L.) Kurz		-	EN	Ray and Saini (2022)
12	*Canarium strictum* Roxb.	Burseraceae	E	EN	IUCN (2023)
13	*Garcinia gummi-gutta* (L.) Robs.	Clusiaceae	E	LC	IUCN (2020)
14	*Garcinia indica* (Thouars) Choisy		E	EN	Manvi and Parasharami (2019)
15	*Garcinia morella* (Gaertn.) Desr.		E	VU	Prabukumar *et al*. (2012)
16	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Combretaceae	-	EN	Ahmad *et al*. (2022)
17	*Terminalia bellirica* (Gaertn.)Roxb.		-	LC	IUCN (2020)
18	*Terminalia elliptica* Willd.		-	VU	Karuppusamy (2018)
19	*Cycas circinalis* L.	Cycadaceae	-	EN	Jansirani (2016)
20	*Cycas revoluta* Thunb.		-	EN	Vijayvergia (2014)
21	*Hopea parviflora* Bedd.	Dipterocarpaceae	E	EN	Sarvalingam and Rajendran (2016)
22	*Hopea ponga* (Dennst) Mabb.		E	LC	IUCN (2020)
23	*Vateria indica* L.		E	CR	Sarvalingam and Rajendran (2016)
24	*Diospyros bourdillonii* Brandis	Ebenaceae	E	CR	Tanwer and Vijayvergia (2014)
25	*Diospyros buxifolia* (Blume) Hiern.		-	NT	Tanwer and Vijayvergia (2014)
26	*Diospyros candolleana* Wight		E	VU	Sarvalingam and Rajendran (2016)
27	*Diospyros malabarica* (Desr.) Kostel.		-	NT	Bhanu (2018)
28	*Diospyros paniculata* Dalzell		E	VU	Jansirani (2016)
29	*Elaeocarpus tuberculatus* Roxb.	Elaeocarpaceae	-	VU	Karuppusamy (2018)
30	*Elaeocarpus munroi* (Wight) Mast.		E	NT	Tanwer and Vijayvergia (2014)
31	*Rhododendron arboreum* Sm.	Ericaceae	-	VU	Anjana (2020)
32	*Butea monosperma* (Lam.) Kuntze	Fabaceae		EN	Rao and Krishnamurthy (2021)
33	*Dalbergia latifolia* Roxb.		-	VU	Sarvalingam and Rajendran (2016)
34	*Entada rheedei* Spreng.		-	EN	Arun Kumar *et al*. (2020)
35	*Prioria pinnata* (Roxb. ex DC.) Breteler		E	EN	IUCN (2020)
36	*Pterocarpus marsupium* Roxb.		-	VU	Rao *et al*. (2019)
37	*Pterocarpus santalinus* L.f.		E	EN	IUCN (2021)
38	*Saraca asoca* (Roxb.) W.J.de Wilde		-	EN	Ankur *et al*. (2014)
39	*Gnetum edule* (Willd.) Blume	Gnetaceae	-	EN	Soosair *et al*. (2007).
40	*Gyrocarpus americanus* Jacq.	Hernandiaceae	-	VU	Tanwer and Vijayvergia (2014)
41	*Mappia nimmoniana* (J.Graham) Byng & Stull	Icacinaceae	-	EN	Shrivastava *et al*. (2021)
42	*Vitex altissima* L.f.	Lamiaceae	-	LC	IUCN (2019)
43	*Litsea coriacea* (B.Heyne ex Nees) Hook.f.	Lauraceae	E	NT	Tanwer and Vijayvergia (2014)
44	*Machilus glaucescens* (Nees) Wight		E	LC	IUCN (2024)
45	*Strychnos nux-vomica* L.	Loganiaceae	-	EN	Ahmad *et al*. (2022)
46	*Strychno spotatorum* L. f.		-	LC	IUCN (2024)
47	*Magnolia champaca* (L.) Baill. ex Pierre	Magnoliaceae	E	VU	Chen and Wang (2018)
48	*Grewia tiliifolia* Vahl	Malvaceae	-	EN	Navendu (2017)
49	*Pterospermum reticulatum* Wight &Arn.		E	VU	Narasimhan and Irwin (2021)
50	*Dysoxylum malabaricum* Bedd. ex C.DC.	Meliaceae	E	EN	Jansirani (2016)
51	*Khaya senegalensis* (Desv.) A.Juss.		-	VU	IUCN (1998)
52	*Swietenia macrophylla* King.		-	VU	Anjana (2020)
53	*Swietenia mahagoni* (L.) Jacq.		-	NT	IUCN (2020)
54	*Artocarpus hirsutus* Lam.	Moraceae	E	VU	Sarvalingam and Rajendran (2016)
55	*Myristica malabarica* Lam.	Myristicaceae	E	VU	IUCN (2023)

S. No.	Botanical name	Family	Endemic	Threatened status	Reference
56	*Syzygium cumini* (L.) Skeels	Myrtaceae	-	VU	Anjana (2020)
57	*Syzygium stocksii* (Duthie) Gamble		E	CR	Narasimhan and Irwin (2021)
58	*Phyllanthus indofischeri* Bennet	Phyllanthaceae	-	VU	Jansirani (2016)
59	*Aegle marmelos* (L.) Correa	Rutaceae	-	VU	Tadwalkar *et al*. (2020)
60	*Chloroxylon swietenia* DC.		-	VU	Gowthami *et al*. (2021)
61	*Vepris bilocularis* (Wight & Arn.) Engl.		E	EN	Narasimhan and Irwin (2021)
62	*Santalum album* L.	Santalaceae	-	VU	IUCN (2018)
63	*Dimocarpus longan* Lour.	Sapindaceae	-	NT	Tanwer and Vijayvergia (2014)
64	*Madhuca bourdillonii* (Gamble) H.J.Lam	Sapotaceae	E	CR	Narasimhan and Irwin (2021)
65	*Madhuca longifolia* (J.Koenig ex L.) J.F.Macbr.		-	EN	Ray and Saini (2022)
66	*Mimusops elengi* L.		-	NT	Sarvalingam and Rajendran (2016)
67	*Aquilaria malaccensis* Lam.	Thymelaeaceae	-	CR	Tanwer and Vijayvergia (2014)

E-Endemic; CR-Critically Endangered; EN-Endangered; VU-Vulnerable; NT-Near Threatened

Conclusion

The Nilgiri Biosphere Reserve is one of the most bio-diverse regions in India, hosting a wide range of both exotic and indigenous species The indigenous species include Vulnerable, Endangered, Critically Endangered ones. Further, *Madhuca bourdillonii* treated to be extinct is now found in small populations in this region. Many recorded species are over-exploited for medicinal and non-medicinal purposes and hence it is inevitable to frame appropriate measures for their protection.

नीलगिरि बायोस्फीयर रिजर्व (एनबीआर), दक्षिणी पश्चिमी घाट, भारत की संकटग्रस्त वृक्ष प्रजातियों का आकलन

वेरिसक्कैया सक्कमुथुआ, अरियान सर्वलिंगम और
औथिनारायणन राजेश

सारांश

पश्चिमी घाट संकटग्रस्त प्रजातियों के लिए दुनिया का दूसरा सबसे महत्वपूर्ण आश्रय स्थल है। दक्षिणी पश्चिमी घाट क्षेत्र का एक हिस्सा, नीलगिरि बायोस्फीयर रिजर्व, भारतीय उपमहाद्वीप के सबसे समृद्ध जैव-भौगोलिक क्षेत्रों में से एक है। वर्तमान अध्ययन में 50 वंशों और 35 कुलों से संबंधित कुल 68 प्रजातियों का दस्तावेजीकरण किया गया है। प्राकृतिक संसाधनों के अतिदोहन और अन्य मानवजनित गतिविधियों जैसे कुछ संकटग्रस्त कारक मौजूदा पारिस्थितिकी तंत्र पर प्रतिकूल प्रभाव डालते हैं और भविष्य में कई प्रजातियों की दुर्लभता का कारण बनते हैं। इसलिए, अध्ययन से पता चलता है कि इस क्षेत्र में कई स्थानिक और संकटग्रस्त प्रजातियों की उपस्थिति के कारण पारिस्थितिक रूप से संवेदनशील वन क्षेत्रों को संरक्षित करने की आवश्यकता है।

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