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# Documenting angiosperm diversity and assigning economic and conservation value of kaan forests: Traditionally managed climax sacred landscapes in sagar taluk of central western ghats, India

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## Abstract

The present study attempts to explore the traditionally managed Kaan forests in Sagar taluk of Central Western Ghats, Karnataka floristically. These Kaan forests are climax forest patches distributed along with agricultural and normal deciduous forest landscapes in the Malnad region literally meaning hilly landscapes of the Central Western Ghats. The angiosperm plant species were enumerated in selected four Kaan forests by laying transects covering a total area of 2 ha. The study of angiosperm floristic composition comprises of 59 families, 129 genera and 159 species. Of the total species, 119 (75%) species were evergreen, 108 (68%) endemic, 21 (13%) threatened and 149 (94 %) species were economically highly valued species. The study found that 93 species were medicinal, 50 species were fodder/manure species, 43 fuel wood species and 38 and 25 species were having timber and edible importance respectively. In this study we also tried to assess total importance value for each species by assigning scores to 10 different uses. The information of economic use for each species was gathered by consulting knowledgeable individuals and also by referring related literature. Study also tried to assign the conservation value of the Kaan forests.

## INTRODUCTION

Undervaluation of natural resources or habitat would cause huge loss to the biological diversity regionally or nationally and it may leads to the misuse of system [1]. At the same time valuation of natural resource will provide a tool to conserve any undervalued resources or habitats. The forest resources play an important role in providing cash income to the local people. These resources are underestimated because of it's freely availability in the nature. In view of ruthless use of such resources, people adopted or believed in traditional systems like religious belief in protecting or sustainable use of natural resources. Kaan forests are one such unique forest patches in the Malnad regions of Karnataka plateau in the Central Western Ghats of India, once regarded as safety forests [2] or reserve forests [3] of indigenous people for procuring agricultural resources, food and medicine as well as aesthetic purposes are being undervalued in recent years threatening to the unique biodiversity treasure trove of this region for the conversion of monoculture plantations and agricultural expansion.

Sacred forest patches of the Western Ghats are known by different names in different parts. The forested districts of Shimoga and Uttara Kannada in the Central Western Ghats of Karnataka are dotted with several groves with lofty lush-green primary forest cover known as 'Kaan'; literally meaning "thick evergreen forests" [4]. These forest patches are also called 'Devar Kaan' (sacred forest), as the natives of these regions preserve Kaan forests traditionally as the abodes of sylvan deities maintaining a lasting relationship with nature [5],[6]. Kaan forests are the symbols of the good old traditional practice of conservation, and are also finest examples of community-managed resources, as practiced in the Western Ghats [3]. As a result of these, we still possess the great heritage of a diverse gene pool of many forest species. Resources such as black pepper and wild nutmeg were harvested from these forests and were used in trade during the pre-colonial period [8]. Today Kaan forests are regarded as the relics of natural climax vegetation, as they harbour several rare and sensitive endemic plant species. Threatened (RET), endemic, and sensitive evergreen species like *Dipterocarpus indicus*, *Madhuca bourdillonii*, *Syzygium travancoricum*, *Gymnacranthera canarica*, *Myristica fatua* var. *magnifica* and recently described tree species of *Semecarpus kathalekanensis* were reported from some of the Kaan forests of Uttara Kannada district of Central Western Ghats [9].

Unique traditional systems developed by the indigenous people passed on to them by generations to conserve forest patches in this part of the region. However, in recent past due to loosened in the strict taboos by the influence of modern life styles in the ethnic communities particularly among younger generations of the society, the value of Kaan forests as well as it's precious resources are in the verge of extinction. In view of valuation of resources and assigning the conservation significance of this remarkable protected sacred landscapes are the main objectives of this study.

## STUDY AREA

Sagar taluk of Shimoga district in the Karnataka state, India is the study area (Fig. 1) located between the latitude 14º 05' and 14º 13' N latitude and 74º 50' and 75 º 09' E longitude. The total geographic area of Sagar taluk is 193,999 ha of which 66,125 ha (34%) is covered with forests. Study area is composed of four recognized vegetations viz. dry scrub and deciduous vegetation to the east contrasted with evergreen and semi-evergreen forests in the hills. Kaan forests are the unique landscape of this taluk among other forest landscapes distributed in all parts of the study area. In the earlier studies 82 Kaan forests have been reported in the Sagar taluk [6]. Officially 8% of the land is covered by Kaan forests in contrast to the total forest cover of the study area.

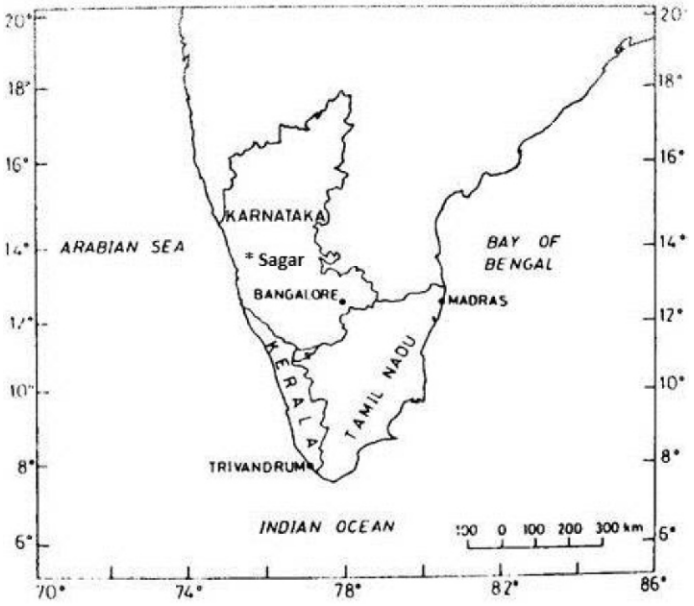


**Fig. 1.** Map showing study site

## METHODS

Angiosperm floristic documentations were conducted in four well managed Kaan forests of Sagar taluk namely Hunsur, Pandavara kodlu, Hosgunda and Jambani Kaan forests (Table 1.) in the year 2011. Hunsur and Pandavara kodlu Kaans distributed in hilly regions with high rainfall (2000 to 2500 mm) where as Hosgunda and Jambani Kaans are in the plains with comparatively moderate rainfall (1500 to 2000 mm) of Sagar taluk.

In order to study the floristic diversity, transect methods were adopted. Transect of 1000 m length and 5 m breadth was laid in each of the selected Kaan forests. To study the recruits and shrubby vegetation, two 25 $m^2$ nested plots were placed in each transect, one at the beginning and another at the end of transect. Herb layers were documented by putting two 1 $m^2$ quadrats. All the plants encountered in transect as well as in regenerating and herb quadrats were identified to the species level with help of regional standard keys and floras. The economic uses of the identified plants were gathered by consulting local knowledgeable individuals as well as from the published literature [10], [11]. Total Economic Values (TIV %) of each species were calculated by using formula [12]

TIV% = where, TIV % is the total importance value and U is the importance value for each particular use. The use of the species were calculated by considering 10 important uses [13] such as food, medicine, manure/fodder, edible oil, dye, fibre, timber, gums/resin, fuel wood and others. These 10 parameters have been weighted on a scale of 0-3 points (0-nill, 1-minimum, 2-moderate, 3-maximum use) to economic value for each use can be assigned and the total importance value (TIV) (potential importance of the plant to the local economy) has thus been calculated. Information of evergreen, endemic, rare, endangered and threatened (RET) plant species were procured from the available literature [14].

## RESULTS AND DISCUSSION

### *Floristic composition*

Kaan forests are more specious with high level distribution of evergreen, endemic and threatened (RET) species (Fig. 2) (Table 2). From the sampled four Kaan forests, a total of 159 plant species of 129 genera belonging to 59 diverse families were recorded. Of which trees (60%) were the major life forms followed by Shrubs (22%), lianas (9%), climbers (4%), herbs (3%) and palms (1%). Among angiosperm families, Rubiaceae is the dominant family with 11 species followed by Euphorbiaceae 10 species, Moraceae 9, Ebenaceae and Meliaceae 8 and 7 species respectively (Fig. 3). Of the total species, 75% (119 species) were evergreen species, in which 75 species were trees, 26 species were shrubs, 11 species were lianas and 5 and 2 species were climbers and palms respectively.

### *Endemic and Threatened species*

A total of 108 (68%) endemic species to the Western Ghats region were encountered in the Kaan forests. Of which 65 species were trees, 24 were shrubs, 9 were lianas, 8 were

**Table 1.** Details of sampled location

| Location | Area (ha) | Latitude (N) | Longitude (E) | Altitude (m) | Area Sampled (ha) |
|---|---|---|---|---|---|
| **Hunsur Kaan** | 33.8 | N $14^0$ 11' | E $74^0$ 55' | 598 | 0.5 |
| **Pandavara kodlu Kaan** | 2.5 | N $14^0$ 08' | E $74^0$ 56' | 644 | 0.5 |
| **Hosgunda Kaan** | 260 | N $14^0$ 06' | N $14^0$ 06' | 624 | 0.5 |
| **Jambani Kaan** | 15 | N $14^0$ 13' | E $75^0$ 09' | 739 | 0.5 |

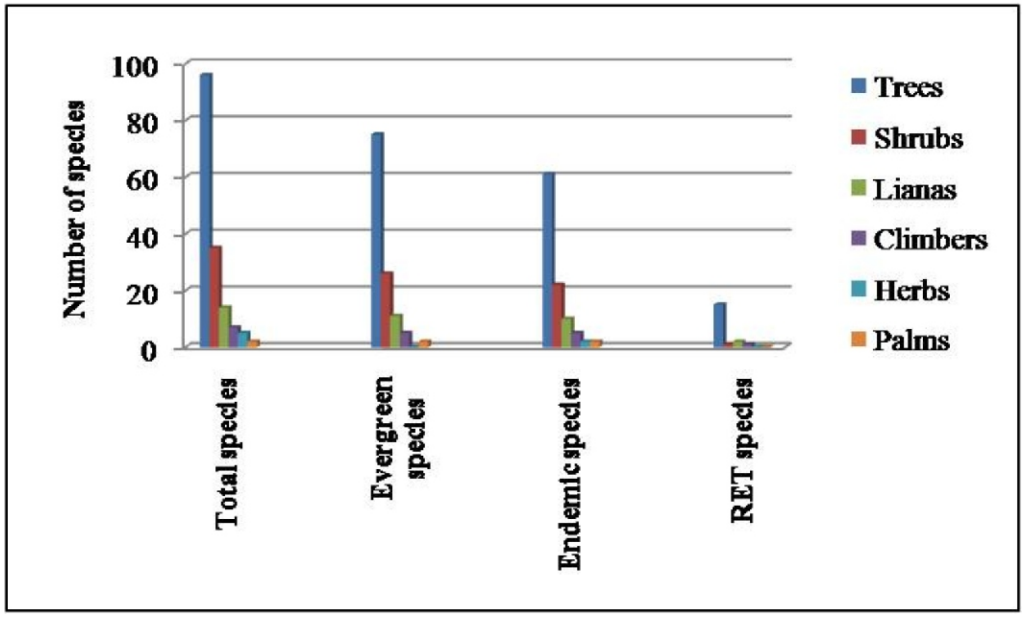


**Fig. 2.** Life forms of plant species with different categories

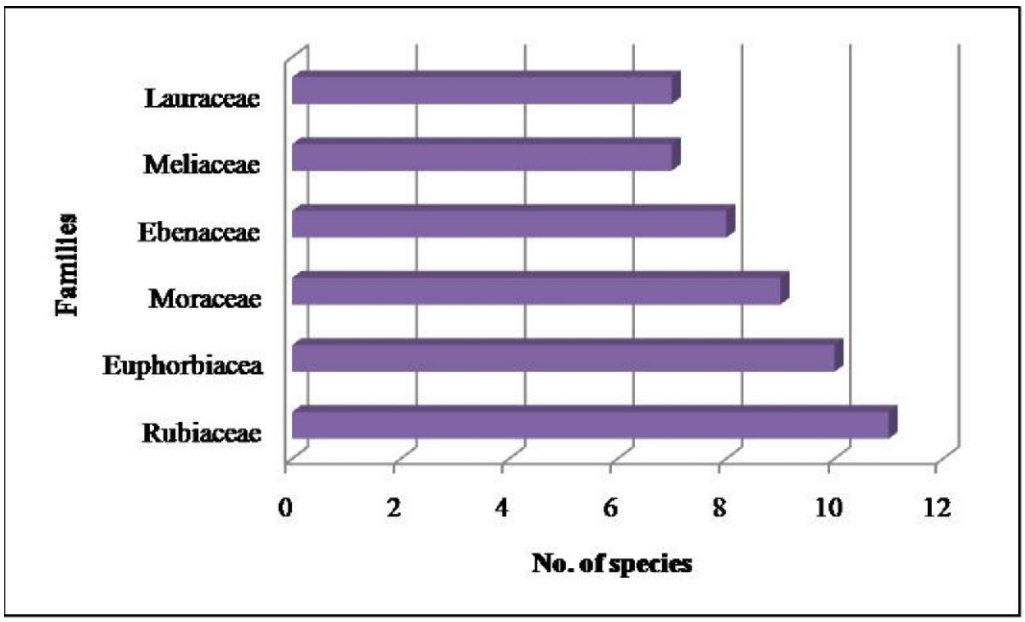


**Fig. 3.** Dominant families in the study locations

climbers and 1 species each were belonged to palms and herbs respectively (Fig. 2). In addition 21 (13%) species were having rare, endangered and threatened (RET) status. In which, 9 species each were endangered and vulnerable, 3 species were belonged to Low risk near threatened categories. In threatened status, trees (16 species) were the major life forms followed by lianas and shrubs (2 species) and climber (1 species) (Fig. 2).

### *Economically Important species*

Economically important species are the plants which have social and economic value. In the socio-economic context, these economically important plants play a vital role both in the rural and urban economy. It is estimated that, as much as 60% of the house-hold income originates from NTFP in the Western Ghats of India [15]. It is believed that Kaan forests are also source of income of rural economy. In Kaan forests, there were 149 (94%) species having economic significance (Table 2). Of which 93 species were medicinal, 50 species were fodder/manure species, 43 fuel wood species and 38 and 25 species were having timber and edible importance (Fig. 4) respectively. The Total Importance Value (TIV %) for each species, *Mangifera indica* (53%), *Grewia tilifolia* (43%), *Garcinia gummi-gutta* (40%), *Garcinia morella* (40%) and *Syzygium cumini* (40%) were the major economically important species with highest TIV value followed by *Artocarpus heterophylla* (37% ), *Garcinia indica* (37%) and *Memecylon umbellatum* (37%) were the next important species (Table 2.).

The prudent manner of protection and traditional management systems of the local community helped in sustainable use of the resources, which enables the chance of

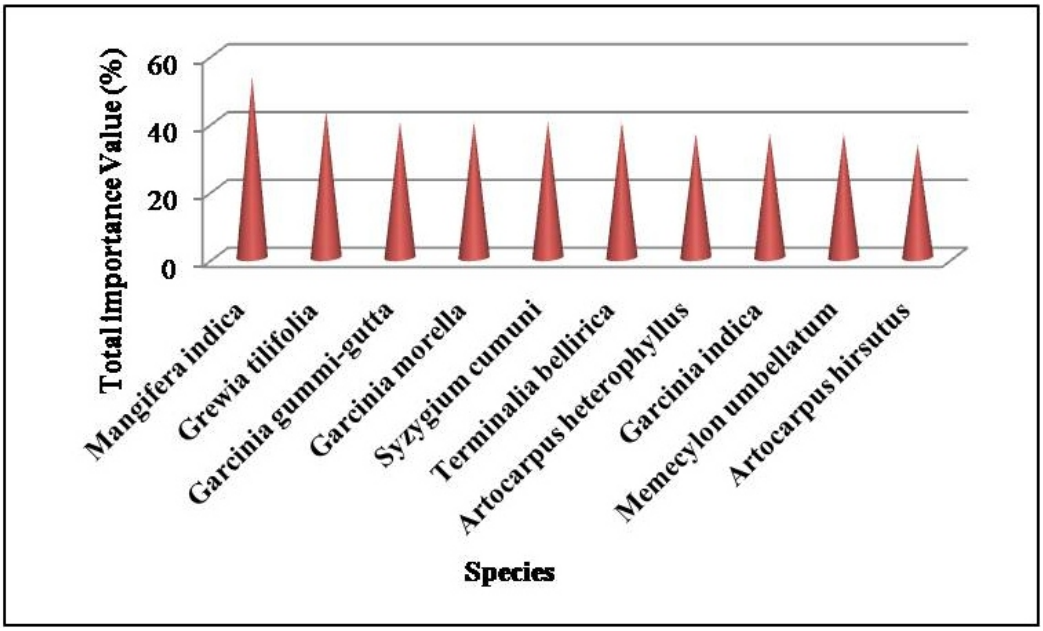


**Fig. 4.** Top 10 highly utilized species

survival of high proportion of evergreens, endemics, threatened (RET) as well as economically important and relic species in the tiny forested patches as compared to other forests in the Western Ghats.

### *Conservation value of Kaan forests*

Since Kaan forests are more specious as compared to any other neighboring forest patches or similar with that of other good evergreen patches of Western Ghats [16], [17] as they harbouring highest percentage of evergreens (75%), endemics (68%), threatened species (13%) and economically high valued species (94%) as well. Besides the high level of endemism and threatened species, these Kaan forests are a place of refuge for several relic threatened species such as *Dipterocarpus indicus*, *Myristica dactyloides*, *Knema attenuata*, *Antiaris toxicaria*, *Canarium strictum* and plays an important role as seed centers [18] by dispersing them to surrounding areas to uphold the local vanishing floras. Therefore these Kaan forests could be conserved

**Table 2.** List of plants found in Kaan forests of Sagar taluk according to their percentage of economic importance value, their distribution, uses and threat status

| Plant Species | Family | Habit | Local name | Distribution | Status | Uses | TVI (%) |
|---|---|---|---|---|---|---|---|
| ***Mangifera indica* L.** | Anacardiaceae | T | Maavu | E | LRnt | Food, Fodder/manure, timber, fuelwood | 53 |
| ***Grewia tilifolia* Vahl.** | Tiliaceae | T | Kankauri | NE | Vu | Food, Fibre, Fodder/manure, fuelwood | 43 |
| ***Garcinia gummi-gutta* (L.) Robson** | Clusiaceae | T | Uppage | E | LRnt | Food, medicinal, fodder, edible oil | 40 |
| ***Garcinia morella Gaertn) Desr.*** | Clusiaceae | T | Ardala | NE | | Edible oil, dye, fodder, medicinal, poles | 40 |
| ***Symplocos cochinchinensis* (Lour.) Moore subsp. Lauriana (Retz.) Noot.** | Symplocaceae | S | Chungu | NE | | Medicinal | 40 |
| ***Tabernaemontana heyneana* Wall.** | Apocynaceae | S | Halmeti | E | Vu | Medicinal | 40 |
| ***Artocarpus heterophyllus* Lam.** | Moraceae | T | Halasu | E | | Food, medicinal, manure/fodder, timber | 37 |
| ***Garcinia indica* (Thouars) Choisy** | Clusiaceae | T | Murugalu | E | En | Food, medicinal, fodder, edible oil | 37 |
| ***Memecylon umbellatum* N. Burman** | Melastomaceae | T | Halchare | E | | Manure/fodder, fuelwood, medicinal | 37 |
| ***Artocarpus hirsutus* Lam.** | Moraceae | T | Hebbalsu | E | | Food, medicinal, manure/fodder, timber | 33 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ***Ixora brachiata* Roxb.** | Rubiaceae | T | Gorbale | E | Vu | Manure/fodder, fuelwood | 33 |
| ***Murraya paniculata* (L.) Jacq.** | Rutaceae | S | Karibevu | E | | Food | 30 |
| ***Myristica dactyloides* Gaertn.** | Myristicaceae | T | Rampatre | NE | | NTFP | 30 |
| ***Aporosa lindleyana* Bail.** | Euphorbiaceae | T | Salle | E | | Food, medicinal, manure/fodder | 27 |
| ***Caryota urens* L.** | Arecaceae | P | Baine | NE | | Food | 27 |
| ***Diospyros crumenata* Thw.** | Ebenaceae | T | Tumru | E | | Timber, manure | 27 |
| ***Gnetum ula* Brogn.** | Gnetaceae | L | Koogale | E | | Wood, Manure, Fuelwood | 27 |
| ***Memecylon malabricum* (Cl.) Cogn.** | Melastomaceae | S | Architti | E | | Manure/fodder, fuelwood | 27 |
| ***Canthium dicoccum* (Gaertn.) Merr.** | Rubiaceae | T | Hanigere | E | Vu | Food, fodder/manure | 23 |
| ***Dichapetulum gelonoides* Engl.** | Dichapetalaceae | S | Kankadle | NE | | Manure/fodder | 23 |
| ***Diospyros candolleana* Wt.** | Ebenaceae | T | Krikumara | E | | Timber, manure | 23 |
| ***Flacourtia montana* Graham** | Flacourtiaceae | T | Hannu sampige | E | Vu | Food, Manure/fodder, fuelwood | 23 |
| ***Hopea ponga* (Dennst.) Mabberly** | Dipterocarpaceae | T | Haiga | E | | Manure/fodder, gum/resin | 23 |
| ***Hydnocarpus pentandra* (Buch.-Ham) Oken** | Flacourtiaceae | T | Shulti | E | | Medicinal | 23 |
| ***Mammea suriga* (Buch.-Ham ex Roxb.) Kosterm.** | Clusiaceae | T | Suragi | E | | Medicinal | 23 |
| ***Mimusops elengi* L.** | Sapotaceae | T | Ranjala | NE | Vu | Food, timber | 23 |
| ***Zanthoxylum ovalifoium* Wt.** | Rutaceae | S | Aramadlu | E | Vu | Food, medicinal | 23 |
| ***Aphanamixis polyastchya* (Wall.) Parker** | Meliaceae | T | Rohit | NE | | Medicinal | 20 |
| ***Cinnamomum macrocarpum* Hook. F.** | Lauraceae | T | Dalchini | E | En | NTFP | 20 |
| ***Dimocarpus longan* Lour.** | Sapindaceae | T | Kankindala | E | | Timber, manure | 20 |
| ***Dysoxylum malabaricum* Bedd. Ex Hiem** | Meliaceae | T | Devdaru | E | | Timber, medicinal | 20 |
| ***Entada persuetha* DC.** | Mimosaceae | L | Ganpe balli | E | | Medicinal | 20 |
| ***Margaritaria indica* (Dalzell) Airy Shaw** | Euphorbiaceae | T | Kempanala | E | | Fuelwood | 20 |
| ***Piper hookeri* Miq.** | Piperaceae | C | Kalu menasu | E | | Food, NTFP | 20 |
| ***Pongamia pinnata* L.** | Fabaceae | T | Honge | NE | | Manure/fodder, fuelwood | 20 |
| ***Aphananthe cuspidata* (Bl.) Planch.** | Ulmaceae | T | Naru Bhootala | E | Vu | Timber, Fodder/manure | 17 |
| ***Breynia retusa* (Denst.) Alston** | Euphorbiaceae | S | Kaadu nugge | NE | | Medicinal, Fodder/manure | 17 |
| ***Canarium strictum* Roxb.** | Burseraceae | T | Karidhoopa | NE | En | Gums/resin | 17 |
| ***Casearia rubescens* Dalzell** | Flacourtiaceae | T | Sumbala mara | E | | Manure/fodder, Fuelwood | 17 |
| ***Chonemorpha fragrans* (Moon) Alston** | Apocynaceae | L | Chandra huvina balli | NE | | Medicinal | 17 |
| ***Chukrasia tabularis* A. Juss.** | Sapotaceae | T | Gandagarke | E | | Timber, medicinal | 17 |
| ***Diospyros buxifolia* (Bl.) Heirn.** | Ebenaceae | T | Sannele karimara | E | Vu | Fuelwood, manure/fodder | 17 |
| ***Diospyros montana* Roxb.** | Ebenaceae | T | Balgane | NE | En | Medicinal | 17 |

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|---|---|---|---|---|---|---|---|
| ***Diospyros paniculata* Dalz.** | Ebenaceae | T | Karimumara | E | | Timber/manure | 17 |
| ***Dipterocarpus indicus* Bedd.** | Dipterocarpaceae | T | Garjan | E | | Timber | 17 |
| ***Lagerstroemia microcarpa* Wt.** | Lythraceae | T | Nandi | NE | | Timber, Manure/fodder | 17 |
| ***Lantana camara* L.** | Verbenaceae | S | Chaduranga | NE | | Fuelwood, fodder/manure | 17 |
| ***Leea indica* (Burm. f.) Merr.** | Leeaceae | S | Dippanige | NE | | Manure/fodder | 17 |
| ***Macaranga peltata* (Roxb.) Mueller** | Euphorbiaceae | T | Chandakalu | E | En | Manure | 17 |
| ***Putranjeeva roxbhurghii*** | Euphorbiaceae | T | Putranjeeva | NE | | Medicinal | 17 |
| ***Saraca asoca* (Roxb.) W.J. de Wilde** | Fabaceae | T | Ashoka | NE | | Medicinal | 17 |
| ***Strombosia ceylanica* Gardn.** | Olacaceae | T | Kari kadam | E | | Fuelwood, manure | 17 |
| ***Vepris bilocularis* (Wt. & Arn.) Engler.** | Rutaceae | T | Kadkanchi mara | E | | Medicinal | 17 |
| ***Alangium salvifolium* (L.f.) Wang.** | Alangiaceae | L | Ankole | NE | | Medicinal | 13 |
| ***Artocarpus gomeianus* Wall. ex Trecul ssp. zeylanicus Jarrete** | Moraceae | T | Vate | NE | | Food | 13 |
| ***Bischofia javanica* Bl.** | Euphorbiaceae | T | Neela | E | | Timber | 13 |
| ***Calamus thwaitesii* Becc.** | Arecaceae | S | Betta | E | | Rattan | 13 |
| ***Cansjera rheedii* Gmel.** | Icacinaceae | S | Kardisoppu | NE | | Medicinal | 13 |
| ***Dalbergia latifolia* Roxb.** | Fabaceae | T | Beete | NE | | Timber | 13 |
| ***Diospyros oocarpa* Thw.** | Ebenaceae | T | Karimara | E | | Manure/fodder | 13 |
| ***Mallotus philippensis* (Lam.) Mueller** | Euphorbiaceae | T | Kunkuma | NE | | Fuelwood | 13 |
| ***Memecylon wightii* Thw.** | Melastomaceae | S | Halchare | E | | Manure/fodder, fuelwood | 13 |
| ***Olea dioica* Roxb.** | Oleaceae | T | Bili masse | E | | Fuelwood, manure | 13 |
| ***Orophea zeylanica* Hook. f. & Thoms.** | Annonaceae | T | Sanagouri | E | En | Manure/fodder, fuelwood | 13 |
| ***Pandanus furcatus* Roxb.** | Pandanaceae | S | Mundige | E | | Medicinal | 13 |
| ***Persea macrantha* (Nees) Kosterm.** | Lauraceae | T | Gulmavu | NE | | Fodder/manure, timber | 13 |
| ***Polyalthia coffeoides* J. Hk. & Th.** | Annonaceae | T | Gaouri mara | E | En | Fuelwood, fibre, manure | 13 |
| ***Pothos scandens* L.** | Araceae | C | Appachi balli | E | | Fodder/manure | 13 |
| ***Salacia oblonga* Wall. ex Wight & Arn.** | Celastraceae | L | Saptharangi | NE | | Medicinal | 13 |
| ***Xantolis tomentosa* (Roxb.) Rafin** | Sapotaceae | T | Kumpholi | E | | Food, Fuelwood | 13 |
| ***Steriospermum personatum* (Hassk.) Chatterjee.** | Bignoniaceae | T | Talctuppa | NE | | Timber, fuelwood | 13 |
| ***Vitex altissima* L. f.** | Verbenaceae | T | Banage | E | | Timber, manure | 13 |
| ***Zanthoxylum rhetsa* (Roxb.) DC.** | Rutaceae | T | Jumma | E | | Food, wood | 13 |
| ***Ailanthus triphysa* (Denst.) Alston** | Simaroubaceae | T | Maddi dhoopa | NE | | Gums/resin | 10 |
| ***Alstonia scholaris* R. Br.** | Apocynaceae | T | Maddale | NE | | Medicinal | 10 |
| ***Carallia brachiata* (Lour.) Merr.** | Rhizophoraceae | T | Andi | E | | Medicinal | 10 |
| ***Chionanthus malabaricus* (Wall. ex G. Don) Bedd.** | Oleaceae | T | Akkerkalu | E | | Fuelwood | 10 |

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|---|---|---|---|---|---|---|---|
| *Chromolaena odoratum* (L.) King & Robins. | Asteraceae | S | Kangress | NE | | Manure | 10 |
| *Dimorphocalyx beddomei* (Benth.) A. Shaw | Euphorbiaceae | T | ----- | E | | Manure/fodder | 10 |
| *Diospyros assimilis* Bedd. | Ebenaceae | T | Karimara | E | | Timber | 10 |
| *Diospyros sylvatica* Roxb. | Ebenaceae | T | Kari tumru | E | En | Timber/manure | 10 |
| *Ixora nigricans* Wt, & Arn. | Rubiaceae | S | ----- | E | | Manure/fodder | 10 |
| *Knema attenuata* (Hook. f. & Thoms.) Warb. | Myristicaceae | T | Hedaglu | E | | Medicinal | 10 |
| *Litsea floribunda* (Bl.) Gamble | Lauraceae | T | Dhade mara | E | En | Fodder/manure | 10 |
| *Naravelia zylanica* | Ranunculaceae | C | Talvadathada balli | E | LRnt | Medicinal | 10 |
| *Nothapodytes nimmoniana* (Graham) Mabbler. | Icacinaceae | S | Helgodasa | NE | | Medicinal | 10 |
| *Smilax zeylanica* L. | Smilacaceae | C | Heggarni balli | NE | | Medicinal | 10 |
| *Sterculia guttata* Roxb. | Sterculiaceae | T | Basavanate | NE | | Seeds edible | 10 |
| *Streblus asper* Lour. | Moraceae | T | Mitli | NE | | Medicinal, religious, edible | 10 |
| *Strychnos nux-vomica* L. | Loganiaceae | T | Kasarka | NE | | Manure/fodder, medicinal | 10 |
| *Toddalia asiatica* (L.) Lam | Rutaceae | S | Kan nimbu | E | | Medicinal | 10 |
| *Uvaria narum* (Dunal) Wt. & Arn. | Annonaceae | S | ----- | E | | Fuelwood, manure, medicinal | 10 |
| *Actinodaphne hookeri* | Lauraceae | T | Tudgenasu | E | | Medicinal, Food | 7 |
| *Actinodaphne malabarica* Balak. | Lauraceae | T | Tudgenasu | E | | Medicinal, Food | 7 |
| *Alstonia venenta* Brown in Mem. | Apocynaceae | T | Maddale | E | | Medicinal | 7 |
| *Beilschmedidia wightii* Benth. ex J. Hk. | Lauraceae | T | Kamatti | E | | Timber | 7 |
| *Callicarpa tomentosa* (L.) Murray | Verbenaceae | S | Taudatti | E | | Medicinal | 7 |
| *Chrysophyllum lanceolatum* (Bl.) DC. | Sapotaceae | T | Haale | E | | Food, timber | 7 |
| *Clerodendron infortunatum* L. | Verbenaceae | S | Taggi gida | NE | | Medicinal | 7 |
| *Combretum ovalifolium* Roxb. | Combretaceae | L | Piloka | NE | | Fuelwood/Manure | 7 |
| *Ficus callosa* Willd. | Moraceae | L | Nayi vate | E | | Medicinal | 7 |
| *Ficus nervosa* Roth. | Moraceae | T | Neeratti | E | | Fodder | 7 |
| *Ficus tsjahela* N. Burman | Moraceae | T | Basari | NE | | Medicinal, fodder | 7 |
| *Ficus virens* Aiton | Moraceae | T | Bili basari | NE | | Religious | 7 |
| *Glochidion malabaricum* Bedd. | Euphorbiaceae | T | Neersalle | E | | Fuelwood, fodder/manure | 7 |
| *Gouania microcarpa* DC. | Rhamnaceae | L | Shingar balli | E | | Manure/fodder | 7 |
| *Harpulia arborea* (Blanco) Radlk. | Sapindaceae | T | Bidsale | E | | Fuelwood, fodder/manure | 7 |
| *Meyna laxiflora* Robyns | Rubiaceae | S | Dodda khare | E | | Fodder, medicinal | 7 |
| *Manilkara hexandra* (Roxb.) Dubard | Sapotaceae | T | Chikni | NE | | Food, timber | 7 |
| *Nothopegia racemosa* (Dalz.) Ramam. | Anacardiaceae | T | Gandu holagere | E | | Medicinal | 7 |
| *Paramigyna monophylla* Wt. | Rutaceae | S | Kan kanchi | E | | Medicinal | 7 |

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|---|---|---|---|---|---|---|
| ***Pinnanga dicksonii* Blume Rumph** | Arecaceae | P | Pandavara adike | E | Fencing | 7 |
| ***Psychotria dalzelli* J. Hk.** | Rubiaceae | S | Kan yelakki | E | Fodder/manure | 7 |
| ***Psychotria flavida* Talb** | Rubiaceae | S | Kan yelakki | E | Fodder/manure | 7 |
| ***Psychotria sp*** | Rubiaceae | S | Kan yelakki | NE | Fodder/manure | 7 |
| ***Psychotria nigra* (Gaertn.) Alston** | Rubiaceae | S | Kan yelakki | E | Fodder/manure | 7 |
| ***Pterospermum reticulatum* Wt. & Arn.** | Sterculiaceae | T | Kesala | E | Fuelwood | 7 |
| ***Raphidophora laciniata* (N. Burm.) Merrill** | Araceae | C | Adka balli | E | Fodder, medicinal | 7 |
| ***Sarcostigma kleinii* Wt. & Arn.** | Olacaceae | L | Haladi hannina balli | E | Medicinal | 7 |
| ***Strobilanthus ixiocephalus*** | Acanthaceae | S | Gurige | E | Manure | 7 |
| ***Syzygium cumuni* (L.) Skeels** | Myrtaceae | T | Nerale | NE | Food, medicinal, fodder/manure, timber | 7 |
| ***Syzygium laetum* (Buch.-Ham) Gandhi** | Myrtaceae | T | Kanjambe | E | Fodder/manure | 7 |
| ***Terminalia bellirica* (Gaertn.) Roxb.** | Combretaceae | T | Tari | NE | Timber, manure/fodder, medicinal, fuelwood | 7 |
| ***Tetrameles nudiflora* R. Br.** | Datisticaceae | T | Madivalada mara | NE | Manure | 7 |
| ***Uvaria hookeri* King.** | Annonaceae | S | ----- | E | Fuelwood, manure | 7 |
| ***Aganosma cymosa* (Roxb.) G. Don** | Apocynaceae | T | Halballi | E | Medicinal | 3 |
| ***Aglaia jainii* Viswa. & Ramachan.** | Meliaceae | T | Nyavala | E | Fuelwood | 3 |
| ***Aglaia elaegnoidea* (Juss.) Benth. var. courtallensis (Gamble) K.K.N. Nair** | Meliaceae | T | Nyavala | E | Fuelwood | 3 |
| ***Antiaris toxicaria* Lesch.** | Moraceae | T | Ajanapatti | NE | Fibre | 3 |
| ***Barleria courtallica* Nees** | Acanthaceae | S | Kadu gorantige | E | Manure/fodder | 3 |
| ***Canthium angustifolium* Roxb.** | Rubiaceae | S | Balli hangere | E | Manure | 3 |
| ***Capparis tenera* Dalz.** | Capparidaceae | S | Mullu gida | E | Medicinal | 3 |
| ***Croton zeylanicus* M. Aerg.** | Euphorbiaceae | S | ----- | E | Manure/fodder | 3 |
| ***Diploclisia glaucescens* (Blume) Diels** | Menispermaceae | L | Ambali | E | Manure/fodder | 3 |
| ***Elaeocarpus serratus* L.** | Elaeocarpaceae | T | Chungale | E | Fuelwood | 3 |
| ***Eugenia macrocephala* Duthie** | Myrtaceae | S | Kan jambe | E | Manure/fodder | 3 |
| ***Euonymus indicus* B. Heyne ex Wall.** | Celastraceae | T | Kadudasal | E | Manure/fodder, fuelwood | 3 |
| ***Genianthus laurifolius* (Roxb.) Hook.*f.*** | Asclepiadaceae | C | ----- | E | Medicinal | 3 |
| ***Gompandra tetrandra* (Wall.) Sluemer** | Icacinaceae | S | ----- | E | Medicinal | 3 |
| ***Hippocratea indica* Willd.** | Hippocratea | C | Daushir | E | Fuelwood, fodder/manure | 3 |
| ***Hiptage madablota* Gaertn.** | Malpighiaceae | L | Madavi late | E | Medicinal | 3 |
| ***Holigarna arnottiana* J. Hk.** | Anacardiaceae | T | Holageru | E | Medicinal | 3 |
| ***Holigarna grahamii* (Wt.) Kurz.** | Anacardiaceae | T | Dodda holageru | E | Medicinal | 3 |

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|---|---|---|---|---|---|---|
| ***Homalium ceylanicum* (Gardner) Benth.** | Flacourtiaceae | T | Kalmattige | E | Fuelwood, fodder/manure | 3 |
| ***Jasminum ritchiei* C.B. Cl.** | Oleaceae | C | Kadu mallige | E | Medicinal | 3 |
| ***Reinwaedtiodendron anaimalaiense* (Bedd.) Mabb.** | Meliaceae | T | Nyavala | E | Fuelwood, fodder/manure | 3 |
| ***Moullava spicata (dalz.) Nicolson* (Dalz.) Nicolson** | Fabaceae | L | Huliyuguru balli | E | Fencing | 3 |
| ***Nervilia infundibulifolia* Blatt. & McCann** | Orchidaceae | H | Nelavali | E | | 3 |
| ***Catunaregam spinosa* (Thunb.) Tirveng.** | Rubiaceae | S | Khare | NE | Fish poison | 3 |
| ***Toona ciliata* Roemer** | Meliaceae | T | Gandhagarike | E | Timber | 3 |
| ***Trichilia connaroides* (Wt. & Arn.) Benth.** | Meliaceae | T | Kadu garige | E | Fuelwood, manure | 3 |
| ***Ventilago madraspatana* Gaertn.** | Rhamnaceae | L | Gapsandi balli | E | Fuelwood, manure | 3 |
| ***Zizyphus oenoplia* (L.) Mill.** | Rhamnaceae | S | Pargi | NE | Food, medicinal, fodder | 3 |
| ***Canscora perfoliata* Lam.** | Rubiaceae | H | Nela kilwara | NE | Fodder | 0 |
| ***Celtis philippensis* Blanco.** | Ulmaceae | T | Peenari | NE | Wood | 0 |
| ***Justecia sps*** | Acanthaceae | H | ----- | NE | Fodder | 0 |
| ***Litsea mysorensis* Gamble** | Lauraceae | T | Sunnangi | NE | Fodder | 0 |
| ***Malaxis sps.*** | Orchidacee | H | ----- | NE | | 0 |
| ***Micromeria capitellata* Bth.** | Lamiaceae | C | ----- | E | | 0 |

Abbreviations :
T- Tree, S- Shrub, L- Liana, C- Climber, H- Herb, P-Palm, E- Ebdemic, NE- Non-Endemic, En- Endangered, Vu- Vulnerable, LRnt- Low risk near threatened, TIV- Total Importance Value, ha- hectare, m- meter, N- North, E- East.

as ecologically sensitive sites similar to Ecological Sensitive Areas (ESAs) proposed to be established all along the Western Ghats [10]. However, similar suggestions were made to too many forest patches by several authors in their studies in Western Ghats.

## CONCLUSIONS

Kaan forests are good old traditionally managed protected forests by indigenous people due to various religious and cultural beliefs. These sacred forests are repositories of large number of evergreens, endemics, threatened as well as economically highly valued species, particularly the Kaan forests plays a key role as refuge for several sensitive endemic and threatened species such as *Dipterocarpus indicus*, *Pinnanga dicksonii*, *Myristica dactyloides*, *Dysoxylum malabaricum*, *Garcinia gummi-gutta* etc. Apart from amazing species richness, Kaan forests are also render ecological goods and services like maintaining ground water table, local microclimatic conditions [20], [21] and agricultural resources. By strengthening social taboos and traditional management system and also creating awareness of importance of Kaan forests among younger generations, conservation of these relic forests is vital in the vision of threats to pristine forests in the Western Ghats in near future.

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