RESEARCH ARTICLE

Conservation of woody tree species at Nadukani Tropical gene pool garden in Nilgiri Biosphere Reserve (India)

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ABSTRACT

In this present study, conservation of tree species was enumerated with an object to determine the composition of tree diversity, endemism and its threatened status at Nadukani Tropical Gene Pool in Nilgiri Biosphere Reserve. Totally 62 woody tree species belonging to 52 genera and 31 families were enumerated. Lauraceae and Moraceae were the dominant plant families and the genera Ficus and Syzygium were the dominant genera. Totally 24 rare and threatened tree species were collected from the study area. Thus the conservation of forest trees in the study area in their native environments targeted the in situ conservation. It is concluded that this comprehensive information on trees diversity of the Nadukani tropical gene pool is a good database which will be useful to implement better conservation strategies and management of tropical forests and ecosystems.

Keywords: Western Ghats, Gene Pool, Conservation, Threatened Plants

INTRODUCTION

The Convention on Biological Diversity Strategic Plan for Biodiversity 2011-2020 was adopted at the 10th Conference of the Parties in Nagoya, Japan with the plan of 20 Aichi Targets to achieve global biodiversity conservation. A fundamental global approach to biodiversity conservation is the use of protected areas (Woodley *et al.,* 2012). They remain one of the most diverse and adaptable management and institutional tools for achieving conservation. Their effectiveness can be measured, evaluated and enhanced. In addition to conserving nature, protected areas are critical for a range of other benefits, including providing ecological services, reducing the impacts of disasters such as flooding, and storing carbon (Dudley *et al.,* 2010, World Bank, 2010). IUCN has developed a system of protected area management categories that helps classify protected areas based on their primary management objectives and recognizes the importance of all categories for biodiversity conservation (Dudley, 2008).

In India, Western Ghats is one of the four hotspots of biodiversity and is a treasure of biological diversity which harbors many endemic species of flowering plants, endemic fishes, amphibians, reptiles, birds, mammals and invertebrates. It is because of this rich biodiversity which is endemic to the region and the fact that Western Ghats are a Centre of origin of many species and hence a cradle for biological evolution, the UNESCO included Western Ghats in the UNESCO World Natural Heritage List (UNESCO, 2012). IUCN affirms that a goal of conservation is the maintenance of existing genetic diversity and viable populations of all taxa in the wild in order to maintain biological interactions, ecological processes and function (IUCN, 2002). To achieve this target, in this paper, conservation of tree species was enumerated with an object to determine the composition of tree diversity, endemism and its threatened status at Tropical Gene Pool.

MATERIALS AND METHODS

Study Area

Tropical Gene Pool Garden was established by the Tamil Nadu Forest Department at Nadugani near Gudalur in Nilgiri Biosphere reserve of Nilgiris District under Hill Area Development Programme (HADP) over 242.14 ha., with the object of *in situ* conservation of existing plant life forms, *ex situ* conservation of endemic and endangered species, reintroduction and recovery programme of endangered species, propagation of fast disappearing plant species and also for education and awareness.

Methods

Intensive field surveys were made in the Tropical gene Pool Garden during the year 2011-2012 to explore the floristic inventory of tree diversity. All the plant specimens available in the study areas were collected for authenticity and the herbarium specimens are prepared by following the standard methods (Jain and Rao, 1976). Photographs were also taken. The herbarium specimens were identified with the help of Floras (Gamble and Fischer,1915-1936;Hooker, 1872-1897; Matthew, 1983). The Flora of Tamil Nadu [(Henry *et al*., 1987; Henry 1989; Nair and Henry, 1983) has been referred for the correct botanical names for the specimens collected and cross checked with International Plant Names Index (http://www.ipni.org/ipni/plantnamesearchpage.do). The plants collected were classified according to the Angiosperm Phylogeny Group III (APG III, 2009). The herbarium specimens were prepared for all the plants and deposited at the Department of Botany, M.R. Govt. Arts College, Mannargudi for reference.

RESULTS AND DISCUSSION

Composition of Tree diversity

In the present study, totally 62 woody tree species belonging to 52 genera and 31 families were enumerated (Table 1). Among top 10 family wise.

Table 1. Woody Tree species recorded from the Tropical Gene Pool Garden

S.No.	Botanical Names	Family
1	*Actinodaphne salicina* Meisn.	Lauraceae
2	*Aglaia elaeagnoidea* (A.Juss.) Benth.	Meliaceae
3	*Allophylus serratus* (Hiern) Kurz	Sapindaceae
4	*Alstonia scholaris* (L.) R. Br.	Apocynaceae
5	*Artocarpus heterophyllus* Lam.	Moraceae
6	*Artocarpus hirsutus* Lam	Moraceae
7	*Atalantia wightii* Yu.Tanaka	Rutaceae
8	*Breynia retusa* (Dennst.) Alston	Phyllanthaceae
9	*Butea monosperma* (Lam.) Taub	Fabaceae
10	*Callicarpa tomentosa* (L.) L.	Lamiaceae
11	*Calophyllum polyanthum* Wall. ex Planch. & Triana	Clusiaceae
12	*Cananga odorata* (Lam.) Hook.f. & Thomson	Annonaceae
13	*Canarium strictum* Roxb.	Burseraceae
14	*Canthium dicoccum* (Gaertn.) Merr.	Rubiaceae
15	*Careya arborea* Roxb.	Lecythidaceae

Table 1. Continued.

S.No.	Botanical Names	Family
16	*Cinnamomum verum* J.Presl	Lauraceae
17	*Cryptocarya lawsonii* Gamble	Lauraceae
18	*Cryptocarya stocksii* Meisn.	Lauraceae
19	*Dalbergia latifolia* Roxb. var. *sissoides* (Wight & Arn.) Baker	Dalbergiaceae
20	*Dalbergia latifolia* Roxb	Dalbergiaceae
21	*Dillenia pentagyna* Roxb.	Dilleniaceae
22	*Dysoxylum malabaricum* Bedd. ex C.DC.	Meliaceae
23	*Elaeocarpus tectorius* (Lour.) Poir.	Elaeocarpaceae
24	*Erythrina stricta* Roxb.	Fabaceae
25	*Evodia lunu-ankenda* (Gaertn.) Merr.	Rutaceae
26	*Ficus callosa* Willd.	Moraceae
27	*Ficus hispida* L.f.	Moraceae
28	*Ficus mollis* Vahl	Moraceae
29	*Ficus nervosa* B.Heyne ex Roth	Moraceae
30	*Garcinia indica* (Thouars) Choisy	Clusiaceae
31	*Glochidion ellipticum* Wight	Phyllanthaceae
32	*Gnidia glauca* (Fresen.) Gilg	Thymelaeaceae
33	*Gordonia obtusa* Wall. ex Wight	Theaceae
34	*Hibiscus tiliaceus* L.	Malvaceae
35	*Holarrhena antidysenterica* (L.) Wall.	Apocynaceae
36	*Holigarna beddomei* Hook.f.	Anacardiaceae
37	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae
38	*Mallotus tetracoccus* (Roxb.) Kurz	Euphorbiaceae
39	*Meliosma simplicifolia* (Roxb.) Walp.	Sabiaceae
40	*Murraya paniculata* (L.) Jack	Rutaceae
41	*Myristica dactyloides* Gaertn.	Myristicaecae
42	*Neolitsea cassia* (L.) Kosterm.	Lauraceae
43	*Olea dioica* Roxb.	Oleaceae
44	*Palaquium ellipticum* (Dalzell) Baill.	Sapotaceae
45	*Persea macrantha* (Nees) Kosterm.	Lauraceae
46	*Phyllanthus emblica* L.	Phyllanthaceae
47	*Psidium guajava* L.	Myrtaceae
48	*Pterocarpus marsupium* Roxb.	Fabaceae
49	*Radermachera xylocarpa* (Roxb.) Roxb. ex K.Schum.	Bignoniaceae
50	*Randia dumetorum* (Retz.) Lam.	Rubiaceae
51	*Rhus mysorensis* G.Don	Anacardiaceae
52	*Solanum erianthum* D. Don	Solanaceae
53	*Spondias pinnata* (L. f.) Kurz	Anacardiaceae
54	*Symplocos racemosa* Roxb.	Symplocaceae
55	*Syzygium cumini* (L.) Skeels	Myrtaceae
56	*Syzygium laetum* (Buch.-Ham.) Gandhi	Myrtaceae
57	*Syzygium tamilnadensis* Rathakr. & V.Chithra	Myrtaceae
58	*Syzygium travancoricum* Gamble	Myrtaceae
59	*Terminalia bellirica* (Gaertn.) Roxb.	Combretaceae
60	*Terminalia catappa* L.	Combretaceae
61	*Vitex altissima* L.f.	Lamiacea
62	*Wendlandia thyrsoidea* (Roth) Steud.	Rubiaceae

Lauraceae and Moraceae were the dominant plant families represented by 17 % with 6 species each followed by Myrtaceae with 14 % (5 species), Anacardiaceae by 11 % (4 species), Fabaceae, Phyllanthaceae, Rubiaceae and Rutaceae by 8 % (3 species each) and Apocynaceae and Clusiaceae by 5 % with 2 species each respectively (Fig. 1). Among generic wise distribution, the genera *Ficus* and *Syzygium* were the dominant genera represented by 20 % with 4 species followed by *Artocarpus*, *Cryptocarya*, *Dalbergia* and *Terminalia* by 10 % with 2 species each and *Actinodaphne*, *Aglaia*, *Allophyllus* and *Alstonia* by 5 % with single species each respectively (Fig. 2). The tree diversity is fundamental to all rain forest biodiversity because trees provide resources and habitat structure for almost all other rain forest (Cannon *et al.,* 1998; Parthasarathy, 2001). It is more authentic to comparable with the adjoining areas of the western ghats. 120 woody species belonging to 86 genera and 44 families were recorded from Chandholi national park (Kanade *et al.,* 2008), 273 species belonging to 181 genera and 62 families from southern eastern ghats (Pragasam and Parthasarathy, 2009), 46 tree species of 44 genera and 31 families including a Gymnosperm were recorded from low altitude forest of western ghats (Shruthakeerthiraja and Krishnakumar, 2012).

Rare and Threatened Plants

The rare and threatened plants collected from the study area were given in the Table 2. Vulnerable category was represented by 25 % (6 species), Rare categories by 21 % (5 species), Critically endangered and Endangered by 17 % (4 species each), Least Concern by. 12% (3 species) and Near Threatened by 8 % (2 species) respectively. It is more opt to compare with the previous reports from the adjacent region. Richard and Muthukumar (2012) reported 98 threatened plants from KMTR, Gopalan and Henry (2000) assessed the status of 125 strict endemics of the Tamil Nadu part of the Agasthiyamalai region's eastern slopes, of which 83 are woody species including 46 species of trees and 37 species of shrubs. Mohanan and Sivadasan (2002) recorded 297 tree species from western slopes (windward side) of the Agasthiyamalai region. Ganesh *et al.,* (1996) recorded 173 species of angiosperms from the Kalakad-Mundanthurai Tiger Reserve, southern Western Ghats,

Table 2. List of Tree species recorded from the Tropical Gene Pool Garden

S.No.	Threat Status	Species
1	Critically Endangered	*Canarium strictum* Roxb. *Breynia retusa* (Dennst.) Alston *Myristica dactyloides* Gaertn. *Syzygium travancoricum* Gamble *Cinnamomum verum* J.Presl
2	Endangered	*Dysoxylum malabaricum* Bedd. ex C.DC. *Garcinia indica* (Thouars) Choisy *Actinodaphne salicina* Meisn.
3	Least Concern	*Alstonia scholaris* (L.) R. Br. *Phyllanthus emblica* L. *Aglaia elaeagnoidea* (A.Juss.) Ben
4	Near Threatened	*Persea macrantha* (Nees) Kosterm. *Terminalia bellirica* (Gaertn.) Roxb *Atalantia wightii* Yu.Tanaka
5	Rare	*Glochidion ellipticum* Wight *Ficus callosa* Willd. *Wendlandia thyrsoidea* (Roth) Steud. *Gordonia obtusa* Wall. ex Wight *Canthium dicoccum* (Gaertn.) Merr. *Cryptocarya lawsonii* Gamble
6	Vulnerable	*Cryptocarya stocksii* Meisn. *Dalbergia latifolia* Roxb *Pterocarpus marsupium* Roxb. *Symplocos racemosa* Roxb.

of which 90 species of trees. Annamalai (2004) reported c. 500 species of trees from the entire Kalakad-Mundanthurai Tiger Reserve. The main general aim and long-term goal of *in situ* conservation of target species is to ensure their survival, evolution and adaptation to changing environmental conditions such as global warming, changed rainfall patterns, acid rain and habitat loss, through taking steps to protect, manage and monitor selected populations in their natural habitats so that the natural evolutionary processes can be maintained, thus allowing new variation to be generated in the gene pool (Hunter and Heywood, 2011). *In situ* conservation is the management of species within their natural environment (Frankel and Soule, 1981; Greenwood, 1996). This method of conservation is preferred for species which are sensitive to disturbance or direct human contact (Bell and Merton, 2002), as they can be managed in their natural habitat, reducing the amount of stress (International Union for Conservation of Nature (IUCN, 1995; Bell and Merton, 2002). This practice is also beneficial as it allows species to remain in the environment to which they are accustomed, and when used over a long temporal scale, it allows the species to maintain its evolutionary traits and adapt naturally (IUCN, 1995). Thus the conservation of forest trees in the study area in their native environments targeted the *in situ* conservation.

CONCLUSION

Thus from the present findings, it is concluded that this comprehensive information on trees diversity of the Nadukani at NBR, is a good database which will be useful to implement better conservation strategies and management of tropical forests and ecosystems.

Conflicts of interest: The authors stated that no conflicts of interest.

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