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ECOLOGICAL IMPORTANCE OF TWO LARGE HERITAGE TREES IN MOYAR RIVER VALLEY, SOUTHERN INDIA

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Ecological importance of two large heritage trees in Moyar River valley, southern India

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Large old trees are considered as 'keystone structures' because of their humungous size and disproportionately high production of resources for multiple species in an ecosystem (Manning et al. 2006). They play a significant role in providing ecological services and maintaining the ecosystem function in various ecosystems (Lindenmayer et al. 2013; Lindenmayer & Laurance 2017). Large old trees are often called heritage trees for their natural and cultural significance as they function as critical habitat for a wide array of species in large landscapes (Dean et al. 1999; Jim 2017). The decline of large old trees would negatively influence the environment, and the species that depend on them may even face the risk of local extinction, thus affecting the ecological integrity (Manning et al. 2006; Lindenmayer et al. 2013; Lindenmayer & Laurance 2017).

Numerous animals, including insects, reptiles, birds, herbivores, carnivores, and other species immensely depend on large trees for shelter, shade, and food, especially in tropical dry forests that usually support large populations of emblematic species like tigers, leopards, and elephants. The large old trees are also the major contributors to the high heterogeneity and biomass of forest landscapes across the globe (Das et al. 2018). Most importantly, they occur at low stem densities, yet influence spatial patterns over long intertree distances (Lutz et al. 2018). Despite their significant role in maintaining the ecological flows, the importance of large trees is often understudied and overlooked in habitat conservation programs (Lutz et al. 2018).

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The Moyar River valley landscape (henceforth MRVL) at the juncture of the Western Ghats and the Eastern Ghats is one among the dry tropical landscape, which supports rich flora, fauna, and act as a habitat for many endangered and heritage species. Especially, the riverine forest along the Moyar River (a major perennial river in the landscape) is one of the remaining contiguous forests in the Nilgiri Biosphere Reserve. The large

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 বিজ্ঞান एवं प्रौद्योगिकी विभाग DEPARTMENT OF SCIENCE & TECHNOLOGY শ্যন নগজ্জ ব্যারাগানেরে ৮০০০ Ecological importance of heritage trees in Moyar River valley



Figure 1. The location of two large trees Hardwickia binata Roxb. & Terminalia arjuna (Roxb ex DC.) Wight & Arn. in Moyar River valley landscape, Tamil Nadu, India.

trees in landscapes like MRVL have special ecological significance as they provide microhabitat for numerous species that have high conservation significance. During the two years (November 2017–January 2020) of vegetation survey that included 500 plots (10m x 10m) established across five major forest types in the MRVL, we came across two large old trees one each of *Terminalia arjuna* (Roxb.) Wight. & Arn. and *Hardwickia binata* Roxb. This article is an attempt to exemplify the ecological significance of these two large old trees in the Moyar River valley landscape (Figure 1).

We recorded an enormous tree of *Terminalia* arjuna (Combretaceae) measuring 32m height and 8.45m girth at breast height (GBH; above buttress) at 11.594°N & 76.846°E, 398m (Image 1). This individual tree occurs in the riparian forest along the Moyar River, where the average canopy height reaches around 25m. This particular tree is a unique landscape feature that marks the tri-junction boundary of three tiger reserves (TR), namely Sathyamangalam TR, Mudumalai TR, and Bandipur TR. Likewise, the large individual tree of

Hardwickia binata (Fabaceae) measuring 21m in height and 4.24m in GBH was observed at $11.537^{\circ}N \& 77.021^{\circ}E$, 324m (Image 2). This individual tree is located in the scrub forest, where the average canopy height is around 5m – four-fold lesser than the observed large old tree.

Terminalia arjuna is a large deciduous tree (local name: 'Neermathi') usually found along the river, dry watercourse, and streams of tropical dry and moist forests in India and Sri Lanka (Kundu & Schmidt 2015). The ecological significance of *T. arjuna* in MRVL includes providing habitat for many species, stabilizing the riverbanks, and trapping the sediments as buttress roots act as an excellent soil binder. Also, the large crown, tall stature of *T. arjuna* is often used by major faunal species such as Elephants, Muggers, Leopards, Sloth Bears, Chital, Grey Langur, and Malabar Giant Squirrel for various purposes. Hence, it is considered a keystone species of the riparian forest in southern India (Sunil et al. 2019).

The largest tree of *T. arjuna* with 14m GBH and an estimated age of 550 years was reported from Javvadhu



Image 1. a—The largest tree of *Terminalia arjuna* recorded at Moyar River valley landscape | b—nesting of White-rumped Vulture in the observed tree | c—the claw marks of Sloth Bear seen in this tree indicating the high use of *T. arjuna* by the animal | d—Spot-bellied Eagle-owl, new record to the checklist of Sathyamangalam Tiger Reserve.

Hills of Tamil Nadu by Vijayasankar et al. (2012). Though the tree that we observed is not the largest ever reported, it has a high ecological value. For example, this individual tree is highly used as a roosting site by four species of vultures, of which three are Critically Endangered namely White-rumped Vulture *Gyps bengalensis* (J.F. Gmelin, 1788), Red-headed Vulture *Sarcogyps calvus* (Scopoli, 1786), and Long-billed Vulture *Gyps indicus* (Scopoli, 1786); and one is endangered Egyptian Vulture *Vulture percnopterus* (Linnaeus, 1758) as per the IUCN Red List data. We have recorded seven nests of White-rumped Vulture on this tree during December 2019. Also many raptors, namely, the Brown Fish-owl *Ketupa zeylonensis* (Gmelin, 1788), Spot-bellied Eagle-owl *Bubo nipalensis* (Hodgson, 1836), Oriental Honey-buzzard *Pernis ptilorhynchus* (Temminck, 1821), Changeable Hawk-eagle *Nisaetus cirrhatus* (Gmelin, 1788), and Shikra *Accipiter badius* (Gmelin, 1788) are observed roosting on this tree. Interestingly, the Spotbellied Eagle-owl is a new record to the faunal checklist of Sathyamangalam Tiger Reserve. These observations signify the conservation importance of large old trees in general and the observed tree in particular.

Hardwickia binata is native to southern and southeastern Asia (Arunkumar & Joshi 2018) representing the only species under the genus Hardwickia (Kumar &

Thirumurugan et al.



Image 2. a—The largest tree of *Hardwickia binata* recorded at Moyar River valley landscape | b—Woodland savannah dominated by *Hardwickia binata* | c—a flowering twig of the tree.

Sane 2003; Sanjappa 2010; Kundu & Schmidt 2011). The records suggest that this species can grow up to 36m tall and 4m GBH (Arunkumar & Joshi 2018). The tree that we observed has the largest GBH as per the available reports. *H. binata* is one of the dominant tree species in the tropical dry deciduous forest of southern India (Meher-Homji 2008). It also commonly occurs in the southern tropical thorn forest, scrub forest, deciduous forest, and woodland savannah of the MRVL (Champion & Seth 1968). In MRVL, *H. binata* (locally called 'Aacha',

'Aachamaram' or 'Karachi') are commonly found along the ridges, furrows, and hillocks.

In MRVL, *H. binata* remains as one of the essential foraging trees for the herbivores where mammals generally prefer the leaves, twigs, and bark. The Asian Elephant *Elephas maximus* intemperately feeds on its bark, leaves, and act as a primary seed-dispersing agent (Sukumar 1992; Baskaran et al. 2010). The Irula's (indigenous community in this landscape) also use this tree species for multiple purposes (timber, firewood

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and to make ropes during local festivals) indicating the cultural ethos associated with this species.

The growing evidence suggests that the large old trees are globally on the decline due to various environmental and anthropogenic drivers (Lindenmayer et al. 2013). Experts particularly urge that the conservation of large old trees require site-specific unique conservation approaches (inclusive of social and cultural aspects) that span over unprecedented spatio-temporal scales (Lindenmayer et al. 2013; Blicharska & Mikusiński 2014; Lindenmayer et al. 2014; Lindenmayer & Laurance 2016). In India, the conservation mechanism adapted to the large Kannimara teak (Tectona grandis L.f.) that occur in Parambikulam Tiger Reserve could serve as a model system for large old trees; where the cultural heritage along with designating a special status (i.e., tree of national importance) made an effective conservation tool for awareness building (Nagarajan et al. 2010). Therefore, implementing new policies to register and recognize the large old trees and mapping their distributions will immensely help in their protection and conservation of associated biodiversity. Besides, future scientific studies focusing on the role that large old trees play in biodiversity conservation and regulating the ecosystem process could provide much-needed insights on the conservation significance of large old trees; which is particularly crucial for the management of highly important wildlife landscapes such as the Moyar River valley landscape. Moreover, such initiatives can play a vital role in the conservation awareness programs designed for local stakeholders.

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