

## Relics of the Past: Biodiversity of the *Myristica* Swamps of the Western Ghats

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Paddy fields are a common repurposing of swamps and other low-lying wetlands

### An Introduction to Freshwater Swamp Ecosystems:

India is home to a variety of natural and man-made wetlands ranging from mangrove forests and coral reefs to lakes, ponds, reservoirs, paddy fields and swamps. Swamps can be either estuarine, such as mangrove swamps, or freshwater, as seen in the hadlus, *Eleocarpus* swamps, and *Myristica* swamps of the Western Ghats biodiversity hotspot, Himalayan foothills, and the Doon Valley. These freshwater swamps are found in low-lying regions and depend upon rainfall

and seasonal flooding to maintain water level fluctuations (Bhat & Kaveriappa, 2009). Swamps are classified as category 4C/FSI Tropical Freshwater Swamp Forests (Champion and Seth, 1980). Nowadays, swamps are often found in pockets of forested land, relatively isolated due to increasing human activity and land use change around their periphery. Major threats to freshwater swamps in the Western Ghats include conversion to paddy fields or arecanut and teak plantations (Bassi *et al.*, 2014). Swamps are India's least understood

wetlands and receive low conservation priority on both national and global policy scales. However, they are valuable for their many ecosystem services.

#### The Ecology of *Myristica* Swamps:

*Myristica* swamps are a type of tropical freshwater swamp forest predominantly composed of species in the family *Myristicaceae* (Krishnamoorthy, 1960). Four genera and 16 species within this family are

found in India. Members of this family are evergreen, water-tolerant trees with stilt and knee roots that help them stay erect and perform vital functions in a submerged environment. Their thin, moist bark and large leaves allow for rapid shedding of water. *Myristica* swamps were first discovered in Travancore in 1960 and are native to the Western Ghats of Kerala, Karnataka, Goa, and Maharashtra. These are some of the most primitive ecosystems on earth.



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Knee roots allow trees to perform basic functions in this swampy ecosystem



Pneumatophores allow for gas exchange between tree roots and the atmosphere despite a submerged environment

### Biodiversity in These Relic Swamp Forests:

Few studies have been conducted on *Myristica* swamps and a small fraction of these focus on qualifying swamp biodiversity. However, thus far, at least 79 tree species, 26 shrubs, 27 climbers, and 44 herb species have been recorded from in and around *Myristica* swamps and likely more species are yet to be discovered (Prabhugaonkar *et al.*, 2014). More than 60 percent of trees recorded in these swamps belong to the Myristicaceae family (Dharmapalan &

Ashokhan, 2013). Prominent tree species include *Syzygium travancoricum* (Gamble), *Gynacranthera canarica* (King), *Myristica fatua* var. *magnifica* (Bedd.), *Dipterocarpus indicus* (Bedd.), *Mastixia arborea* (Wight), *Myristica malabarica* (Lam.), and *Semecarpus kathalekanensis* (Das.) (Roby *et al.*, 2014; Keshavachandra & Krishnakumar, 2016). *Myristica* swamps display high floristic endemism with 23 tree species recorded as endemic to the Western Ghats. Apart from tree diversity, rare tree ferns are dominant in swampy

areas. However, despite high diversity in lower taxa, including algae and fungi, there are no scientific studies on the diversity and composition of these taxa in swamp forests.

*Myristica* swamps also have high faunal diversity. A comprehensive study in the swamps of the southern Western Ghats reported over 630 species ranging from flatworms to large mammals. The same study also recorded 14 species of freshwater fishes and 56 species of amphibians (Nair *et al.*, 2007; Jose *et al.*, 2014). *Myristica* swamps serve as critical amphibian habitat and breeding grounds. In the central Western Ghats (Karnataka), studies reported 26

species of amphibians from *Myristica* swamps (Ali *et al.*, 2008). Few faunal species are exclusively found in these swamps; however, a monotypic frog genus *Mercurana myristicapalustris* was reported from *Myristica* swamps in the western foothills of the Agasthyamalai Hills of Kerala (Abraham *et al.*, 2013). During the monsoon, swamps have slower water flow as compared to other stretches of streams, thus forming ideal breeding grounds for frogs such as *Nyctibatrachus jog*, *N. kempholensis*, and *N. kumbhara* in the central Western Ghats. Post-monsoon breeders such as those in the genus *Micrixalus* are found here as well.

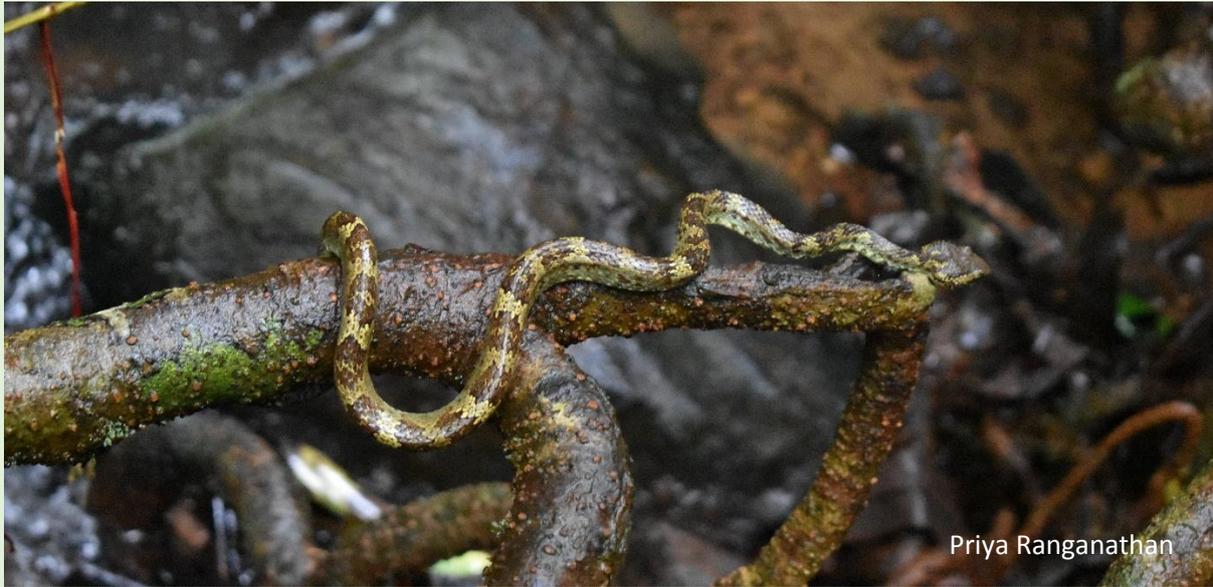


Samyamee Sreevathsa

*Micrixalus kottigeharensis*, commonly known as the dancing frog, is a lesser-known inhabitant of *Myristica* swamps

Studies have reported 206 species of butterflies belonging to six families from the *Myristica* swamps of Kerala (Sujitha *et al.*, 2019). Eighty-two plants in swamps were listed as hosts for butterfly larvae, making swamps a crucial habitat for maintaining India's butterfly diversity. The microclimate in and around these swamps makes them ideal for butterfly nesting and breeding. Furthermore, six endemic species of odonates were reported from freshwater swamps in the Western Ghats; odonates are indicators of ecosystem health and their diversity is directly influenced by aquatic and terrestrial vegetation health. Small changes in the microhabitat within swamps can cause large changes in odonate larvae survival (Subramanian, 2007). Fish species diversity extends across 16 species present in the perennial waters within these swamps in the southern Western Ghats. Three of these species (*Mystus malabaricus*, *Garra gotyla stenorhynchus*, *Salmostoma boopis*) are endemic to this biodiversity hotspot (Ali *et al.*,

2008). The researchers also recorded 21 reptilians, including 13 species of snakes. Of these, the Gunther's supple skink (*Lygosoma guentheri*) and Malabar pit viper (*Trimersurus malabaricus*) are endemic to the Western Ghats. Studies have recorded 59 bird species from these swamps. Large swamps such as Kathalekan in the central Western Ghats host the Indian great-horned owl (*Bubo bubo*). Birds such as the Oriental pied hornbill (*Anthracoceros albirostris*), Malabar Pied Hornbill (*Anthracoceros coronatus*), Malabar Grey Hornbill (*Ocyeros griseus*), and Mountain Imperial Pigeon (*Ducula badia*), as well as mammals such as the Malabar giant squirrel (*Ratufa indica*), lion-tailed macaque (*Macaca silenus*), and Nilgiri langur (*Semnopithecus johnii*) serve as seed dispersers for swamp-specialist tree species in the Myristicaceae family (Krishna & Somanathan, 2014). Additionally, the perennial water sources in *Myristica* swamps attract other large mammals endemic to the Western Ghats biodiversity hotspot.



A Malabar pit viper drapes itself over the knobby knee roots in a *Myristica* swamp in Sirsi, Karnataka

#### Saving these Relic Swamp Forests:

The Western Ghats is one of 34 global biodiversity hotspots, taking up less than six percent of India's terrestrial land cover (Das *et al.*, 2006). This ancient mountain range has high levels of topographic and climate heterogeneity, and harbour high endemism. Despite its high biodiversity, however, only nine percent of the Western Ghats falls within India's protected area network. Today, only 6.8 percent of the original 1,82,500 sq. km. of primary forest remain intact in the Western Ghats (Gunawardene *et al.*, 2007).

*Myristica* swamps face a high threat of destruction than surrounding evergreen forest types as they are typically small and exist outside of protected areas. Freshwater swamps are ecologically sensitive areas, regions of high biodiversity and species richness, and are known to be unique and largely irreplaceable if degraded. Many swamps are in reserve forests, which are not awarded the same level of protection as national parks or wildlife sanctuaries, while others fall within community-protected sacred groves and are protected on religious grounds. However, these designations do not protect swamps from land use conversion, especially drainage for

hydel projects or repurposing for paddy fields, teak, or arecanut plantations (Vijayakumar & Vasudeva, 2011). Draining swamps was found to have higher instances of flooding and erosion downstream during the monsoons, while leading to dry streambeds during the rest of the year. Simultaneously, the soil loses its ability to absorb and retain water, causing a decline in quality and impacting agriculture (Chandran & Mesta, 2006). In the Western Ghats, remaining swamps are highly fragmented and exploited for non-timber forest products, medicinal plant collection, or diverted to irrigate

plantations and fields (Hegde *et al.*, 2017). Diversion can be fatal to the swamp-dwelling trees that depend upon perennially flowing water to disperse seeds and maintain ecological processes. In order to ensure the survival of these primitive swamp forests and their astounding biodiversity, higher protection must be conferred upon them. A co-management approach involving communities, local stakeholders, and the government will be a step towards increasing vigilance and protecting these rare freshwater swamp forests that are relics of the past.

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#### References:

Abraham, R.K., R.A. Pyron, B.R. Ansil, and A. Zachariah. (2013). Two novel genera and one new species of treefrog (Anura: Rhacophoridae) highlight cryptic diversity in the

Western Ghats of India. *Zootaxa*, 3640: 177-189

Ali, S., M.S. Chandran, and T.V. Ramachandra. (2006). Faunal assemblages in *Myristica* swamps of central Western Ghats, Karnataka, India. In *Proceedings of the Symposium on Environment Education and Ecosystem Conservation*. Indian Institute of Science, Bangalore.

Bassi, N., M.D. Kumar, A. Sharma, and P. Pardha-Saradhi. (2014). Status of wetlands in India: A review of extent,

ecosystem benefits, threats and management strategies. *Journal of Hydrology: Regional Studies*, 2: 1-19.

Bhat, P.R. and K.M. Kaveriappa. (2009). Ecological studies on *Myristica* swamp forests of Uttara Kannada, Karnataka, India. *Tropical Ecology*, 50(2): 329-33.

Champion, H.G. and S.K. Seth. (1968). *A Revised Survey of the Forest Types of India*. New Delhi: Manager of Publications.

Chandran, M.D.S and D.K. Mesta. (2006). *Myristica* swamps. *Sahyadri ENews*, Issue 13, [http://wgbis.ces.iisc.ernet.in/biodiversity/sahyadri\\_eneews/newsletter/issue13/index.htm](http://wgbis.ces.iisc.ernet.in/biodiversity/sahyadri_eneews/newsletter/issue13/index.htm).

Das, A., J. Krishnaswamy, K.S. Bawa, M.C. Kiran, V. Srinivas, N.S. Kumar, K.U. Karanth. (2006). Prioritisation of conservation areas in the Western Ghats, India. *Biological Conservation*, 133: 16-31

Dharmapalan, B. and A. Asokhan. (2013). *Myristica* Swamps-Evolutionary Relics. *Science Reporter*: 45-48.

Gunawardene, N.R., D.A. Daniels, I.A.U.N. Gunatilleke, C.V.S. Gunatilleke, P.V. Karunakaran, G.K. Nayak, and G. Vasanthi. (2007). A

brief overview of the Western Ghats-Sri Lanka biodiversity hotspot. *Current Science*, 93(11): 1567-1572.

Hegde, N., R. Ziegler, C. Greiser, and H. Joosten. (2017). A preliminary assessment of landscape features and cultural practices of sacred freshwater swamps in the central Western Ghats, India. *Wetlands Ecology and Management*, 26(1): 49-61.

Jose, J., K.K. Ramachandran, T.J. Roby, and P.V. Nair. (2014). A Preliminary Checklist of Amphibians in and around the *Myristica* swamp forests of Kulathupuzha, South Western Ghats. *Journal of Entomology and Zoology Studies*, 2(1): 11-18.

Keshavachandra, K. and G. Krishnakumar. (2016). Seed germination studies on *Gymnacranthera canarica* (King) Warb, a Vulnerable tree species of a highly threatened *Myristica* swamp ecosystem. *Journal of Threatened Taxa*, 8(7): 9009-9013.

Krishna, S. and H. Somanathan. (2014). Secondary removal of *Myristica fatua* (*Myristicaceae*) seeds by crabs in *Myristica* swamp forests in India. *Journal of Tropical Ecology* 30: 259-263.

Krishnamoorthy, K. (1960.) *Myristica* Swamps in the evergreen forests of Travancore. In *Tropical Moist Evergreen Forest Symposium*, Forest Research Institute, Dehradun.

Nair, P.V., K.K. Ramachandran, K. Swarupanandan, and T.P. Thomas. (2007). Mapping biodiversity of the *Myristica* swamps in Southern Kerala. Kerala Forest Research Institute, Peechi 680653.

Prabhugaonkar, A., D.K. Mesta, and M.K. Janarthanam. (2014). First report of three redlisted tree species from swampy relics of Goa State, India. *Journal of Threatened Taxa*, 6(2): 5503-5506.

Roby, T.J., J. Jose, and P.V. Nair. (2014). Checklist of Flora of *Myristica* Swamps-A critically endangered freshwater ecosystem of Southern Western Ghats of Kerala, India. *Indian Forester*, 140: 608-616.

Subramanian, K.A. (2007). Endemic Odonates of the Western Ghats:

Habitat distribution and conservation. In: *Odonata-biology of dragonflies*. (ed. Tyagi). Scientific Publishers, Jodhpur, India: pp. 257-271.

Sujitha, P.C., G. Prasad, and K. Sadasivan. (2019). Butterflies of the *Myristica* swamp forests of Shendurney Wildlife Sanctuary in the southern Western Ghats, Kerala, India. *Journal of Threatened Taxa*, 11(3): 13320-13333.

Vijayakumar, P.K. and R. Vasudeva. (2011). Characterization of soil properties from freshwater swamps and adjoining evergreen forest area. *Karnataka Journal of Agricultural Sciences*, 24(4): 601-602.



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