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Cover: Watercolour illustrations—Striped Tiger *Danaus genutia*, Common Silverline *Cigaritis vulcanus*, Tamil Lacewing *Cethosia mahratta*. © Mayur Nandikar.

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SHORT COMMUNICATION

Discovery of a new Myristica swamp in the northern Western Ghats of India

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Abstract: Myristica swamps are one of the world's unique freshwater ecosystems. In recent years there has been an increase in reports about their distribution along the Western Ghats. In this paper, we present a new distribution record for Myristica swamps in the northern part of the Western Ghats in Maharashtra. The Myristica swamp is located within the Bhalandeshwar Sacred Grove of Kumbral Bagwadi, Dodamarg Maharastra, India. This forms the second report from the state of Maharastra. Frequent field visits were made to study and document the floral assemblage and biodiversity in the swamp from November 2023 to January 2024. The swamp is dominated by *Myristica magnifica* Bedd. and is part of a sacred grove protected by villagers due to religious beliefs. The second discovery of a Myristica swamp with a gap of just six years points out to the potential existence of more swamps in the region. Therefore, systematic surveys are needed to document undocumented swamps in various areas.

Keywords: Bhalandeshwar Sacred Grove, endemic flora, freshwater ecosystems, Maharashtra, threatened wetland ecosystem, traditional knowledge.

Myristica swamps represent highly important yet one of the threatened freshwater ecosystems of the world. As the name suggests, the plants of the family Myristicaceae dominate the swamps. They offer various ecological services, such as providing fruits of Myristica, which are an important source of food for the threatened hornbills and the habitat for the vulnerable Asian Short-clawed Otters *Aonyx cinereus*. The high watershed value of these swamps supports many rare, endemic flora and fauna (Chandran et al. 2010). With an evolutionary origin of about 140 million years, the swamps are valuable for evolutionary studies (Chandran et al. 1999; Dharmapalan & Asokhan 2013).

Krishnamoorthy (1960) for the first time, shed light on the occurrence of this unique ecosystem from the south Western Ghats of Kerala, India. Since then, their occurrence has also been studied and reported in the states of Karnataka, Goa, and Maharashtra (Gadgil & Chandran 1989; Santhakumaran et al. 1995; Sreedharan & Indulkar 2018). The Myristica swamp reported from Bambarde-Hewale (Sreedharan & Indulkar 2018) of Maharashtra forms the first record of the presence of such an ecosystem in the state and the northernmost record in the Western Ghats.

The literature survey indicates that the swamps have restricted distribution along the Western Ghats of India, occurring in small fragmented areas. In this communication, it is reported that a new site where a Myristica swamp was found in Maharashtra State, India. Pravin Desai runs a homestay and conducts wildlife trails in the different parts of Dodamarg Tilari Bioregion in Dodamarg Taluka of Sindhudurg District of Maharashtra.

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Competing interests: The authors declare no competing interests.

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Methods

During the regular birding trail to Bhalandeshwar Sacred Grove, while searching for Brown Wood-Owls *Strix leptogrammica*, Pravin observed a huge tree of *Myristica magnifica* Bedd. which led to him discovering the Myristica swamp. This finding was subsequently followed by visits to the swamp for further studies. The plants were identified using the book 'Trees of Sahyadri' a leaf-based field guide by Shrikant Ingalharikar and by consulting Dr. Navendu Page.

The area of the sacred grove and the area of the swamp were estimated within the sacred grove using Garmin GPS 72s by walking around the grove and swamp. All the trees in the swamp with a girth at breast height (GBH) of ≥ 30 cm by using a measuring tape, and height by using a Leica geosystem D1 distometer. For *Myristica magnifica*, an obligate swamp specialist, the height and girth of all individuals were recorded. For trees having less than 1.3 cm in height, their girth was visually estimated. Tree seedlings (GBH <10 cm) were enumerated from the sample plots to determine the regeneration status of tree species in the Myristica swamps. Additionally, a checklist was made for other woody plant species to understand the species diversity and identify the associated species in the area. The checklist contains the list of species arranged alphabetically with their conservation status available on the International Union for Conservation of Nature (IUCN) website. Plants of the World Online (POWO) and The International Plant Names Index (IPNI) were used for nomenclature.

Results

The Myristica swamp is located in Bhalandeshwar Sacred Grove at Kumbral Bagwadi (Image 1). The swamp is dominated by *Myristica magnifica*, which has prominent stilt roots (Image 1). The area of the grove and swamp is 8200 m² and 770 m², respectively. A total of 39 plant species were documented (Table 1, Images 3 & 4). Around 70 individuals of *Myristica magnifica* were recorded, out of which 19 individuals with a girth of ≥30 cm and 51 individuals with a girth of <30 cm. Given that 51 out of 70 individuals were <30 cm indicating regeneration of the *Myristica magnifica*. The size class plot for girth and height is given in Figures 1 & 2, respectively. The rank abundance curve shows

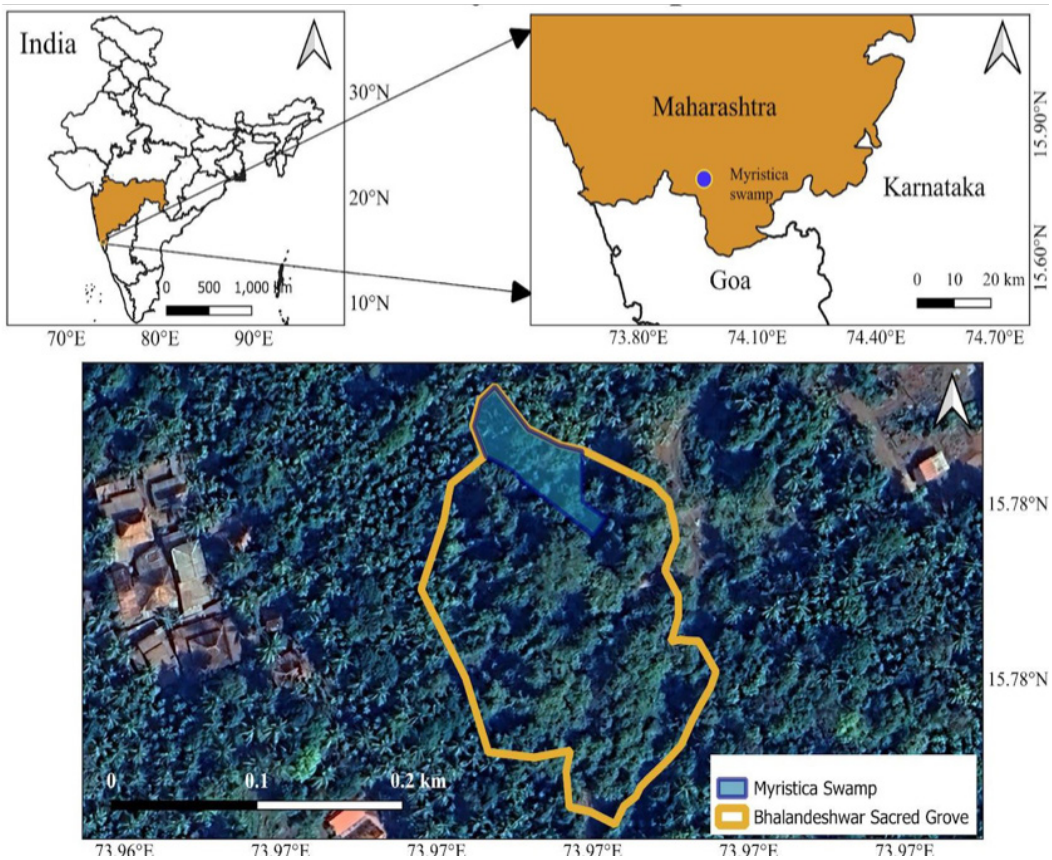

Image 1. Map showing the location of Bhalandeshwar Sacred Grove and the Myristica swamp as of 16 December 2023.

Table 1. Checklist of plants documented in the Myristica swamp of Bhalandeshwar.

	Species name	Family	Habit	IUCN Red List status
1	*Actephila excelsa* (Dalzell) Müll.Arg.	Phyllanthaceae	Small tree	Least Concern
2	*Allophylus cobbe* (L.) Forsyth f.	Sapindaceae	Liana	NA
3	*Anamirta cocculus* (L.) Wight & Arn.	Menispermaceae	Liana	NA
4	*Antidesma nigricans* Tul.	Phyllanthaceae	Shrub	NA
5	*Aporosa cardiosperma* (Gaertn.) Merr.	Phyllanthaceae	Tree	Vulnerable
6	*Artocarpus heterophyllus*	Moraceae	Tree	NA
7	*Artocarpus hirsutus* Lam.	Moraceae	Tree	Least Concern
8	*Bolbitis presiliana* (T.Moore) Ching.	Dryopteridaceae	Fern	Least Concern
9	*Bridelia retusa* (L.) A.Juss.	Phyllanthaceae	Tree	Least Concern
10	*Bridelia scandens* (Roxb.) Willd.	Phyllanthaceae	Scandent shrubs	Least Concern
11	*Calophyllum apetalum* Willd.	Calophyllaceae	Tree	Vulnerable
12	*Capparis* sp.	Capparaceae	Climber	NA
13	*Carallia brachiata* (Lour.) Merr.	Rhizophoraceae	Tree	Least Concern
14	*Caryota urens* L.	Arecaceae	Tree	Least Concern
15	*Chassalia curviflora* (Wall.) Thwaites	Rubiaceae	Shrub	NA
16	*Cleodendron* sp.	Lamiaceae	Shrub	NA
17	*Combretum* sp.	Combretaceae	Herb	NA
18	*Diospyros candolleana* Wight	Ebenaceae	Tree	Vulnerable
19	*Dracaena elliptica* Thunb. & Dalm.	Asparagaceae	Herb	Least Concern
20	*Entada rheedei* Spreng	Fabaceae	Liana	NA
21	*Ficus hispida* L.f.	Moraceae	Tree	Least Concern
22	*Ficus nervosa* Roth	Moraceae	Tree	Least Concern
23	*Flacourtia montana* J.Graham	Salicaceae	Tree	NA
24	*Garcinia indica* (Thouars) Choisy	Clusiaceae	Tree	Vulnerable
25	*Gymnosporia rothiana* (Walp.) M.A.Lawson	Celastraceae	Shrub	NA
26	*Holigarna arnottiana* Hook.f.	Anacardiaceae	Tree	Endemic
27	*Ipomoea campanulata* L.	Convolvulaceae	Climber	NA
28	*Ixora coccinea* L.	Rubiaceae	Shrub	NA
29	*Ixora nigricans* R.Br. ex Wight & Arn.	Rubiaceae	Small tree	NA
30	*Ixora brachiata* Rox.	Rubiaceae	Tree	NA
31	*Lagenandra toxicaria* Dalzell	Araceae	Herb	Least Concern
32	*Leea indica* (Burm.f.) Merr.	Vitaceae	Small tree	Least Concern
33	*Lophopetalum wightianum* Arn.	Celastraceae	Tree	Least Concern
34	*Macaranga peltata* (Roxb.) Müll.Arg.	Euphorbiaceae	Tree	NA
35	*Machilus glaucescens* (Nees) Wight	Lauraceae	Tree	NA
36	*Mimusops elengi* L.	Sapotaceae	Tree	LC
37	*Myristica magnifca* Bedd.	Myristicaceae	Tree	Endangered/ Endemic
38	*Nothopegia castaneifolia* (Roth) Ding Hou	Anacardiaceae	Tree	Critically Endangered
39	*Pandanus furcatus* Roxb.	Pandanaceae	Shrub	NA
40	*Pothos scandens* L.	Araceae	Climber	NA
41	*Premna coriacea* C.B.Clarke	Lamiaceae	Climber	NA
42	*Pterospermum acerifolium* (L.) Willd.	Malvaceae	Tree	Least Concern
43	*Sterculia guttata* Roxb.	Malvaceae	Tree	NA
44	*Tabernaemontana alternifolia* L.	Apocynaceae	Tree	NA
45	*Tetrastigma leucostaphylum* (Dennst.) Alston	Vitaceae	Liana	NA
46	*Thottea siliquosa* E.S.S.Kumar, A.E.S.Khan & Binu	Aristolochiacea	Shrub	NA

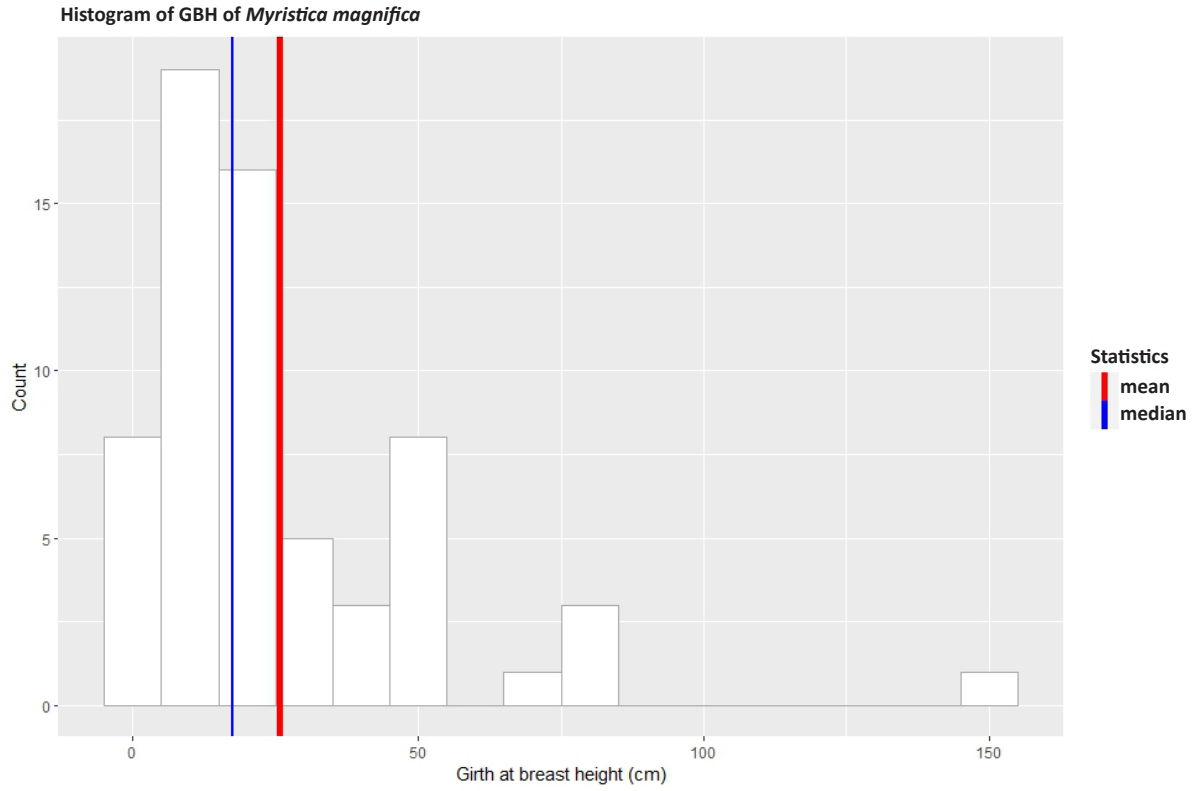

Figure 1. Histogram of girth at breast height of *Myristica magnifica* individuals that were >1.3 cm in height.

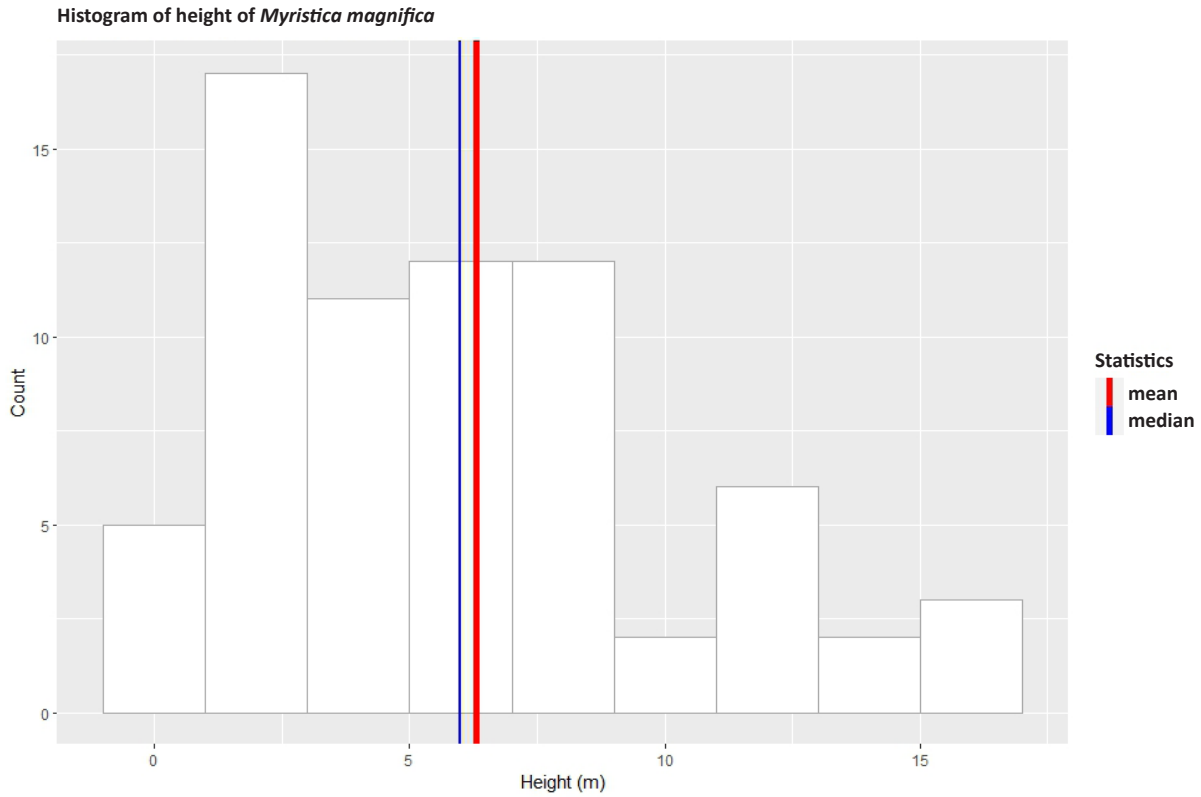

Figure 2. Histogram showing *Myristica magnifica* tree height distributions in the swamp. There is a greater representation of saplings indicating the regeneration of trees in the swamp.

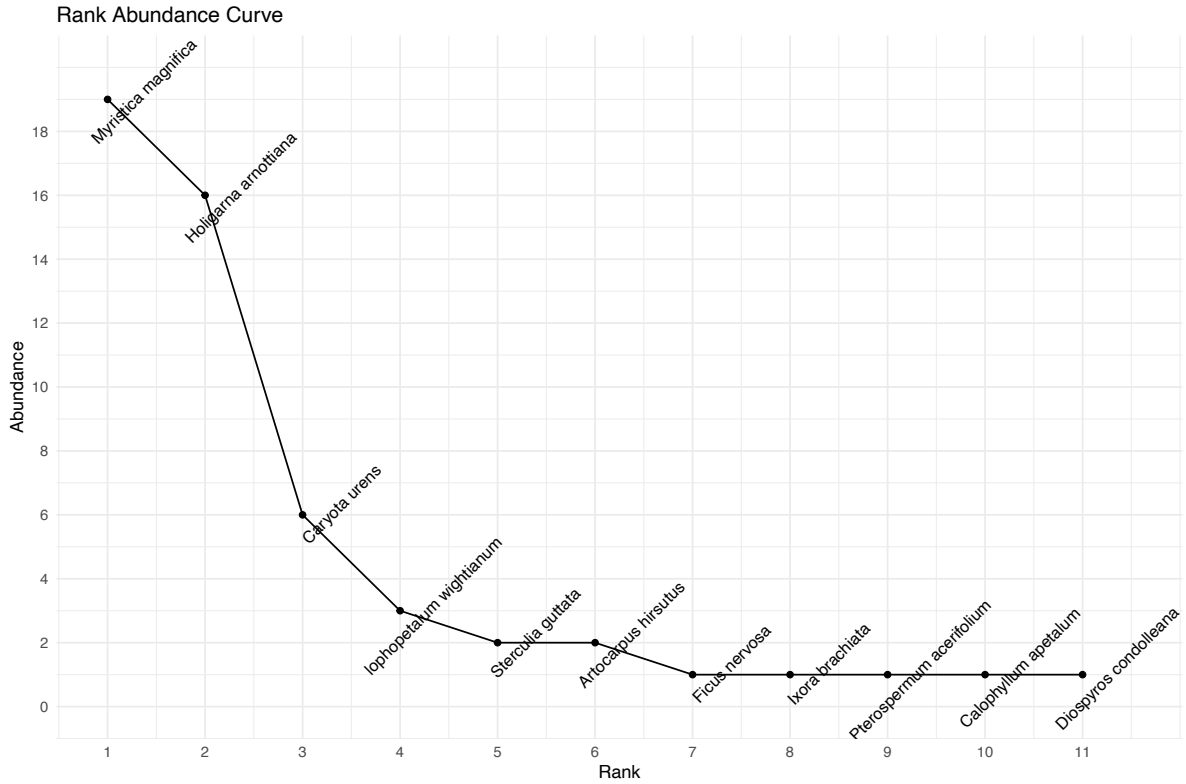

Figure 3. Rank abundance curve for all individual woody plant tree species in the Myristica swamp. Only those individuals with ≥30 cm girth at breast height were included in this plot.

Image 2. A—*Myristica magnifica* with undergrowth of fern, *Bolbitis presiliana*, and edge vegetation | B—Water inundation in the swamp and Stilt roots of *Myristica magnifica* | C—Source of water for the swamp | D—Idol being worshiped in the sacred grove. © Shital Desai.

Image 3. A—*Actephila excelsa* | B—*Allophylus cobbe* | C—*Anamirta cocculus* | D — *Antidesma nigricans* | E— *Aporosa cardiosperma* | F—*Artocarpus heterophyllus* | G—*Artocarpus hirsutus* | H—*Bolbitis presiliana* | I—*Bridelia retusa* | J—*Bridelia scandens* | K—*Calophyllum apetalum* | L—*Capparis* sp. | M—*Carallia brachiata* | N—*Caryota urens* | O—*Chassalia curviflora* | P—*Cleodendron* sp. | Q—*Combretum* sp. | R—*Diospyros candolleana* | S—*Dracaena elliptica* | T — *Entada rheedei* | U—Ficus hispida | V—*Ficus nervosa* | W—*Flacourtia montana* | X—*Garcinia indica*. © Shital Desai.

that the swamp species exhibit low species evenness, with *Myristica magnifica* being the dominant species in the swamp (Figure 3). The undergrowth in the swamp is dominated by the fern *Bolbitis presiliana* (T.Moore) Ching and *Pandanus furcatus* Roxb (Image 2).

Discussion

The local communities worship the deity Bhalandeshwar, who is believed to be an avatar of Lord Shiva and they have been performing religious rituals since the 16th century. The local people practice the ritual of 'Kaul' to seek permission or answers to their

Image 4. A—*Gymnosporia rothiana* | B— *Holigarna arnottiana* | C—*Ipomoea campanulata* | D—*Ixora coccinea* | E—*Ixora nigricans* | F—*Ixora brachiata* | G—*Lagenandra toxicaria* | H—*Leea indica* | I—*Lophopetalum wightianum* | J—*Macaranga peltata* | K—*Machilus glaucescens* | L—*Mimusops elengi* | M—*Myristica magnifca* | N—*Nothopegia castaneifolia* | O—*Pandanus furcatus* | P—*Pothos scandens* | Q—*Premna coriacea* | R—*Pterospermum acerifolium* | S—*Sterculia guttata* | T—*Tabernaemontana alternifolia* | U—*Tetrastigma leucostaphylum* | V—*Thottea siliquosa*. © Shital Desai.

questions. During the temple renovation, they sought permission from the deity Bhalandeshwar to cut and use the tree of *Myristica* for construction. However, they did not receive a positive Kaul from the deity, and thus, the swamp was protected. The spring that emerges at the temple, serves as a source of drinking water for local people. The swamps offer various ecological services, like groundwater recharge, carbon sequestration, natural barriers against floods, habitat, and food for many aquatic and aerial fauna. The fruits of *Myristica* are important food plants for threatened hornbills (Gopal et al. 2021). The occurrence and discovery of this second swamp in the northern Western Ghats of Maharashtra strongly point toward the possibility of more swamps in this region. Therefore, it is necessary to conduct a systematic survey to record the presence of marshes in

various regions. The preservation of this swamp has been motivated by religious values and is imperative to utilise its water resources for several decades sustainably.

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