

Biological marvels of Upper Ganga Ramsar Site in Uttar Pradesh, India

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ABSTRACT

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The 85 km long, riverine Upper Ganga Ramsar Site expands from Brij Ghat in Ghaziabad District to Narora in Bulandshahr District, Uttar Pradesh. The site is endowed with marvelous pristine floristic elements conserved over generations within its 254482 hectare precincts. Its 35 km green corridor from Ram Ghat to Anupshahr along Narora extremities houses the world's tenth largest archaic *Ficus benghalensis* L. (Banyan) tree, the oldest primeval *Manilkara hexandra* (Roxb.) Dubard or the Khirmi tree and the gigantic, virgin *Prosopis cineraria* (L.) Druce or the Shami tree amidst an array of 419 economical and medicinal angiospermous plant species. The site also shelters the only population of rose ringed parakeets (*Psittacula krameri*) of northern India and the critically endangered Gangetic river dolphins (*Platanista gangetica*), the national aquatic animal, along with many other endangered faunal elements. Occurrence of two sacred groves and one sacred site within its limits is also significant. The gamut of biological treasures conserved within the Ramsar precincts calls for pronouncing this eco-sensitive area as a natural world heritage site for further inclusion under the draft protection plan.

Keywords: *Ficus benghalensis*, Gangetic river dolphins, *Manilkara hexandra*, *Prosopis cineraria*, rose ringed parakeets, sacred groves, Upper Ganga Ramsar Site, Uttar Pradesh.

INTRODUCTION

Wetland habitats constitute ecologically sensitive ecotone zones which hold international importance in terms of their functional significance in maintaining ecosystem equilibrium through hydrological cycles responsible for sustaining gamut of bio-resources in the form of floral and faunal elements. The holy river Ganga, which also forms the nucleus of Green Ganga Mission, is endowed with an array of biological entities along its banks emanating the glorious essence of many pristine floristic elements which adorn its catchments. The river originates at an elevation of 7010 m above mean sea level at Gangotri, Garhwal Himalayas of Uttarakhand, flows for c. 2525 km through Siwalik hills, Uttarakhand

plains and meandering in the Indo-Gangetic plains of Uttar Pradesh, Bihar and West Bengal and merges into the Bay of Bengal. Its water flow is maintained by melting of Himalayan glaciers and monsoon rains which makes this riverine ecosystem susceptible to climatic aberrations (Garg 2022). During its course, the river forms cool upland streams and warm water stretches with several wetlands which create natural abode of various biological communities and their populations.

The wetlands of Upper Ganga Ramsar Site constitute a fragile wetland ecosystem which is extremely susceptible to environmental fluctuations and climatic aberrations and are therefore exposed to rigorous seasonal rages of floods and droughts (Garg

2022). The 85 km stretch of the river Ganga from Brijghat to Narora, passing across the Bijnor, Meerut, Moradabad and Bulandshahr districts, was designated as the 'Upper Ganga Ramsar Site', in the year 2005 (Murthy et al. 2013) complimenting the list with the first 'riverine' Ramsar site of India, in the state of Uttar Pradesh. Along with the buffer zone and direct catchments, the site occupies 254482 ha area of wetlands and water pools which regularly support countless ecological communities, many threatened species including the endangered Gangetic dolphins and more than 20000 water birds, thus, satisfactorily qualifies the criteria 2 and 5 of the Ramsar sites. Its wetlands are significant in maintaining hydrological and ecological balance which supports rich diversity of angiosperm species with many significant, economical, medicinal and traditionally important, often pristine, as well as many sacred plants, while also providing suitable habitat for many rare and threatened faunal elements. The present studies were therefore aimed at unearthing the concealed and marvelous biological resources of this internationally important riverine Ramsar site in the state of Uttar Pradesh in India.

MATERIAL AND METHODS

Floristic surveys were conducted during 2012–2017 under the MOEF & CC-BSI project, 'Floristic diversity of the Upper Ganga Ramsar Site, Uttar Pradesh', during all seasons in various regions of the Upper Ganga Ramsar Site. Field observations were made on floristic constituents of the site, including forested zones, and photographs of different landscapes, floral and faunal constituents, vegetation types and other important regions were taken. These surveys covered the two extremities of the Ramsar site, starting from Brij Ghat in Ghaziabad District at 28°10'26" N and 77°07'04" E to Narora Atomic Power Station in Bulandshahr District at 28°47'18" N and 78°25'57" E. All river banks, buffer regions, Ghats, catchments and wetlands, as well as eclipsed forested regions which get flooded intermittently, falling within these bounds were mapped and plants were collected for documentation and authentication. The sites comprised

of forested regions of Jahangirabad, Anupshahr, Ahargaon, Unchagaon, Bhrikukshetra, Mandu, Avantika, Siddhwari, Ramghat, Van Khandeshwar and all associated lands along the sacred river banks, culminating at NAPS, Narora at 28°09' N and 78°24' E. Population status of pristine trees was assessed in the entire zone and number of mature individuals were counted. Assessment on the presence of thriving mature individuals of interesting species was also made and any operational threats in form of anthropogenic, environmental or other factors were recorded.

RESULTS AND DISCUSSION

Among all ecosystems, wetlands are known to possess maximum biodiversity with wide varieties of floral and faunal species. They also protect last remnants of many virgin plants in sacred lands and virgin forests which conserve biodiversity of our planet. These miniature 'ecosystems within ecosystem' provide the avifauna with nesting sites and breeding grounds for rearing young ones (Garg 2016), feeding grounds and critical stops over sites along complex migratory routes and also have the potential to house nurseries and conservatories. Wetlands in general and Ramsar sites in particular, also provide migratory corridors between hydrophytic and terrestrial biological communities and offer phytogeographical sites for studies on evolutionary processes based on comparative analogue of past and present vegetation cover.

The Upper Ganga Ramsar site spreads along the 85 km stretch of the river Ganga from Brij Ghat in Ghaziabad District, to Narora in Bulandshahr District, flowing through four districts, viz. Ghaziabad, Moradabad, Budaun and Bulandshahr (please see Figure 1, in Garg et al. 2016). The river in this region is shallow with intermittent deep-water pools, many riverine islands and open-waters extending to almost 50% of the wetlands, with air and water temperature ranging from 11.5°–35.5°C and 15.6°–30.2°C respectively. The site covers c. 11364 hectares area, between 28°10'26" to 28°47'18" N and 77°07'04" to 78°25'57" E, with c. 167 km perimeter. The complete site is sprawled over 254482 hectares, with c. 130

wetlands housing copious biological wealth in form of countless ecological communities including many threatened faunal species such as the endangered Gangetic River Dolphins (*Platanista gangetica*), common otters (*Lutra lutra*), crocodiles (*Gavialis gangeticus* and *Crocodylus palustris*) and six species of endangered turtles including the Indian soft-shell turtle (*Aspideretes gangeticus*). Its avifauna includes more than 20000 water birds belonging to about 100 species fulfilling the Ramsar Criteria ‘No. 2 and 5’, for which it was declared as a ‘ramsar site’ in the year 2005, complimenting the list of ramsar sites of India with the first ‘riverine’ Ramsar Site.

The floristic components of the site constituted a marvelous assemblage of 419 species with many economically and medicinally important plant species, food and timber resource plants (Garg & Singh 2021) and many tall trees which provide dense canopy cover and green corridors, keystone species along with the pristine trees which amply testify the site as a marvelous treasure-house of biological resources. Their details are as follows:

The oldest *Manilkara hexandra* (Roxb.) Dubard tree of family *Sapotaceae* (Figure 1.A): The oldest *Manilkara hexandra* or the ‘Khirni’ tree with calculated living age of 550 ± 50 yr. turned out to be the oldest extant living specimen (Garg et al. 2021) of the species. It is located at about eight km from the Narora Atomic Power Station, Narora, on north-eastern flank of the river Ganga at 169 m above mean sea level between $28^{\circ}10'38.3''$ N to $28^{\circ}26'46.2''$ N and $78^{\circ}12'36.0''$ E to $78^{\circ}14'12.7''$ E in the dry deciduous forest patch in Van Khandeshwar at Ramghat. Its population spreads along 35 km green corridor extending from Ram Ghat to Anupshahr. It has four other subpopulations of total 34 mature trees, viz. 27 trees in Avantika premises, 4 individuals in Anupshahr and 2 in Shikarpura, hence forming fragmented population of intermittent canopy gaps. First reported as *Mimusops hexandra* by William Roxburgh in 1795 from Coromandel coast (centre of origin) in southeastern coastal region of India, the species was

transferred to the genus *Manilkara* Adans. by Dubard in 1915 and thus became *Manilkara hexandra* (Roxb.) Dubard. Being the oldest living specimen, *M. hexandra* constitutes a repository of wild and virgin gene pool with enormous medicinal and economic attributes (Warrier et al. 1995, Pareek et al. 1998, Kirtikar & Basu 2001). Its bark is used against several colic problems, edible fruit berries are highly nutritious and used as tonic for heart related issues, seeds with c. 25% edible oil are used in opacity of the cornea and its high priced wood is used in making furniture and construction material. Occurrence of such a large wild population of this rare species (Keerthika et al. 2015) which is drifting into RET category due to overexploitation, is significant as other wild populations of the species are rare, except the extant cultivated populations. Further, its less-known archaic gene pool is certain to possess great potential in breeding and genetic engineering schemes for evolving new and disease-resistant varieties.

World’s tenth largest *Ficus benghalensis* L. tree of family *Moraceae* (Figure 1.B): Eclipsed within dense forest thickets of Ram Ghat in Narora at $28^{\circ}10'38.4''$ N, $78^{\circ}12'36''$ E, and 190 m above mean sea level, on the north-eastern flank of river Ganga exists the majestic and unique world’s tenth largest Banyan tree (*Ficus benghalensis* L., Garg et al. 2016). This tree is revered by the local people as the ‘Siddhvriksh’ or ‘wish-fulfilling tree’ and is therefore, guarded against human encroachments and developmental activities which has resulted in its conservation and survival. The gigantic tree, presumably c. 500 years old, forms a miniature sacred grove (Garg et al. 2016) with its colossal canopy covering c. 4069 m² area and branches almost touching the ground towards the land, but drooping and hanging downwards at the river front. Serving as keystone tree, it is inhabited by large population of monkeys (*Macaca* spp.), which is a matter of serious concern due to their combined body weight on drooping branches as also the tree is devoid of prop root supports. It also houses honeybees, large population of birds, several reptiles and an array of insect species.

***Prosopis cineraria* (L.) Druce tree of family Fabaceae** (Figure 1.C): Within the thickets of the Ambikeshwar sacred site, the huge archaic *Prosopis cineraria* tree is revered as sacred ‘Shami’ tree (Garg 2017) adding to the grandeur of the upper Ganga Ramsar Site. This pristine tree is surmounted with a colossal canopy and is believed to exist here since vedic era, unnoticed and undisturbed, obscured within forest thickets and conserved for generations under strict vigil of the local saints and sages as a tree of wealth and symbol of prosperity. Unscathed by the climatic adversities and impervious to anthropogenic disturbances within bounds of the sacred site, this tree–

the only one of its kind, survives as a repository of pristine, unparallel wild gene pool.

The keystone tree chain of *Syzygium cumini* L. (Figure 1.D): This chain of more than hundred years old, *Syzygium cumini* L. trees exist along the fringes of the riverine ramsar site, along 22 km stretch on both edges of the National Highway NH-24 which connects Brij Ghat in Ghaziabad District to Siyana in Bulandshahr District. Located at 28°43.6' N, 78°13.7' E, these aged trees have developed cavities on trunks which are used as nests by the non-migratory rose-ringed parakeets (*Psittacula krameri*). They serve as habitat resource keystone trees for sustaining the huge and only



Figure 1. A. *Manilkara hexandra* (Roxb.) Dubard – ‘Khirmi’ tree at Van Khandeshwar. B. *Ficus benghalensis* L. – The great banyan tree at Ram Ghat. C. *Prosopis cineraria* (L.) Druce – ‘Shami’ tree at Avantika. D. Rows of *Syzygium cumini* L. on National Highway

population of the rose ringed parakeets of northern India (Case 2016) as they offer nesting sites and food resources to these parakeets which in turn, imparts spectacular appearance and a paradise for travelers (Garg & Joshi 2016).

Mandu and Siddhwari sacred groves: The Mandu sacred grove (Garg & Singh 2013a) covered c. 9 ha comprised a virgin forest patch embedded within a mantle of dense vegetation on northeastern flank of the river Ganga, at 28°37' N and 78°27' E, near Unchagaon Fort in Bulandshahr District where twin *Ficus benghalensis* L. tree trunks are revered. Another small Siddhwari sacred grove (Garg & Singh 2013b) in 7 ha area marks the highest elevated point of a triangulate forest approximately 190 m above mean sea level, on the northeastern flank of the river Ganga at 28°10'38.4" N and 78°12'36" E. The main tree of the grove is the archaic *Ficus benghalensis* L. which defied transformation due to the stringent religious beliefs of the people resulting in forbidden developmental activities.

The Ambikeshwar sacred site: The sacred site spreads across 16 ha area at 186 m above mean sea level buffer zone of the Upper Ganga Ramsar site housing the pristine *Prosopis cineraria* (L.) Druce tree, *Manilkara hexandra* (Roxb.) Dubard, *Mitragyna parviflora* (Roxb.) Korth., *Ficus benghalensis* L., *Ficus religiosa* L. and multi-tier vegetation cover of 55 medicinal plant species (Garg 2017) and a thriving ancient 'gurukul' academy in its virgin form.

The sacred groves and sacred sites are endowed with luxuriant vegetation cover and dense tree canopies exemplify pristine forests (Garg 2013) with wild primeval gene pool, useful in genetic engineering and plant breeding for developing resistant varieties. Such lands have not yet been reported within the bounds of the other 78 Ramsar sites of India except the present Upper Ganga Ramsar Site in Uttar Pradesh, which makes it unique in itself. These lands of virgin forests offer last refuge to the diversity rich climax vegetation of representative plant wealth. They also serve as water and primary productivity resource centers of all life forms

and outstanding open carbon systems (Dean & Gorham 1998) for regulating the global carbon cycle with invaluable conserved wild and pristine gene pool. Critical studies on the primitive species conserved within the site also open vistas for future planning and botanical researches on genetic engineering and breeding programs for development of resistant and genetically modified progenies as also they open new horizons for exploration of palaeobotanical history.

The Gangetic river Dolphins (*Platanista gangetica*): Along with botanical wealth, the extremity of ramsar site at Narora, is as an exemplary sanctuary for the critically endangered 'National aquatic animal' – the Gangetic (Ganga) River Dolphins (*Platanista gangetica*). Rare glimpse of these magnificent mammals, when they emerge out of water for a fraction of second to breathe, is a value addition to the radiance and divinity of this religious site representing healthy state of the river waters, as dolphins survive only in clean and fresh water. Awareness regarding conservation of their population is also essential to ensure their long term survival.

CONCLUSION

The diversity of life forms both plants and animals, amidst an array of 419 economically and medicinally useful plant species recorded in the riverine Upper Ganga Ramsar Site (Garg & Singh 2021) is embodiment of on-land and under-soil interface wetland vegetation conserved and thriving within the bounds of the ramsar site comprised of sacred groves, sacred sites, oldest and pristine trees and faunal elements. Such biological marvels which occur in the 35 km long, green corridor between Ram Ghat and Anupshahr exemplify the attributes of this zone as precisely delineated, quaint, eco-sensitive, natural 'world heritage zone' within the precincts of the Upper Ganga Ramsar Site. The corroborated, outstanding biodiversity and existing life forms in this zone, unequivocally and appropriately calls for inclusion of this green belt extending from Ram Ghat at 28°10' N, 78°12' E to Anupshahr at 28°21' N, 78°15' E, in the draft protection plan as "no-construction, no-development and no-mining/quarrying

zone” bearing pristine biological resources, with prohibition on indiscriminate groundwater extraction and dumping of wastes in its vicinity. Being vulnerable to anthropogenic disturbances, as the river banks are largely used as burial grounds, management of its forests and wetland soils is also essential for mitigating adversities to foreground the possibilities of planned resource utilization and a potential tourist place.

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REFERENCES

- Case T.J. 2016. Global patterns in the establishment and distribution of exotic birds. *Biological Conservation* 78: 69-96.
- Dean W.E. and Gorham E. 1998. Magnitude and significance of carbon burial in lakes, reservoirs, and peatlands. *Geology* 26: 535-538.
- Dubard P.M.M. 1915. *Manilkara hexandra* (Roxb.) Dubard. *Ann. Mus. Colon. Marseille, Sér. 3, vol. 3: 9.*
- Garg A. 2013. Typology of sacred groves and their discrimination from sacred sites. *Current Science* 104: 596-599.
- Garg A. 2016. Nest-plant correlation and predator preclusion in Asian Openbill Storks (*Anastomus oscitans*): a case study from Nawabgunj Bird Sanctuary, India. *Indian Forester* 142: 179-186.
- Garg A. 2017. Ambikeshwar sacred site in Upper Ganga – A repository of Primeval flora and Cultural wealth. *Journal of Non-Timber Forest Products* 24: 43-46.
- Garg A. 2022. Predicted impacts of climate change on Upper Ganga Ramsar site in India. *Geophytology* 50: 147-152.
- Garg A. & Joshi B. 2016. Keystone trees in Upper Ganga Ramsar Site sustaining Rose-ringed parakeets (*Psittacula krameri*). *Indian Forester* 139: 1039-1040.
- Garg A. & Singh V. 2013a. Mandu sacred grove in Upper Ganga Ramsar site, Uttar Pradesh *Current Science* 104: 409-410.
- Garg A. & Singh V. 2013b. Siddhwari sacred grove in Upper Ganga Ramsar site of Uttar Pradesh *Current Science* 105: 1039-1040.
- Garg A. & Singh P. 2021. Floristic diversity of Upper Ganga Ramsar Site, Uttar Pradesh, India. *Phytotaxonomy* 19: 93-108.
- Garg A., Singh P. & Garg K. 2016. World's tenth largest banyan tree at Narora in Upper Ganga Ramsar Site, Uttar Pradesh, India. *Current Science* 111: 778-779.
- Garg A., Patrut R.T., Patrut A., Woodborne S. & Rakosy L. 2021. Radiocarbon dating and status of the oldest extant Ceylon iron wood (*Manilkara hexandra*) in the riverine Ramsar Site of India. *Current Science* 120: 562-566.
- Keerthika A., Shukla A.K. & Khandelwal V. 2015. Popularization of *Manilkara hexandra* (Khirni) – an endangered, underutilized fruit tree for conservation and utilization. *Current Science* 109: 1010-1011.
- Kirtikar K.R. & Basu B.D. 2001. *Indian Medicinal Plants*. *Oriental enterprises* 3: 2058-2061.
- Murthy T. V. R. & Patel J. G., Panigrahy S. and Parihar J. S. 2013. *National Wetland Atlas: Wetlands of International Importance under Ramsar Convention SAC/EPISA/ABHG/NWIA/ATLAS/38/2013*. Space Applications Centre (ISRO), Ahmedabad, India.
- Pareek O.P., Sharma S. & Arora R.K. 1998. Underutilized edible fruits and nuts: an inventory of genetic resources in their regions of diversity. *International Plant Genetic Resources Institute (IPGRI)*, New Delhi, Pp. 73.
- Warrier P.K., Nambiar V.P.K. & Ramakutty C. 1995. *Indian Medicinal Plants: A Compendium of 500 Species*, vol. 3, Orient Longman Private Limited, Hyderabad, Pp. 393.