

AQUATIC AND WETLAND PLANTS OF INDIA



Actinoscirpus grossus



Aeschynomene aspera



Nymphaea nouchali



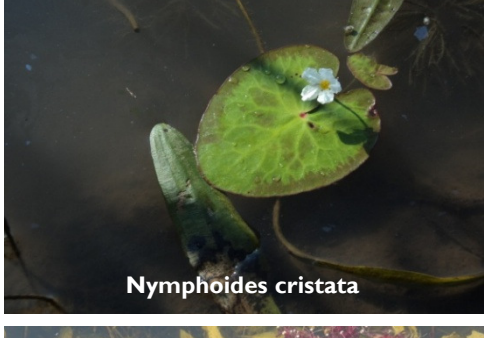
Nymphaea rubra



Azolla pinnata



Drosera burmannii



Nymphoides cristata



Nymphoides indica



Eichhornia crassipes



Enydra fluctuans



Nechamandra alternifolia



Ottelia alismoides



Ipomoea aquatica



Limnocharis flava



Pistia stratiotes



Rhizophora mucronata



Cover page photo legends

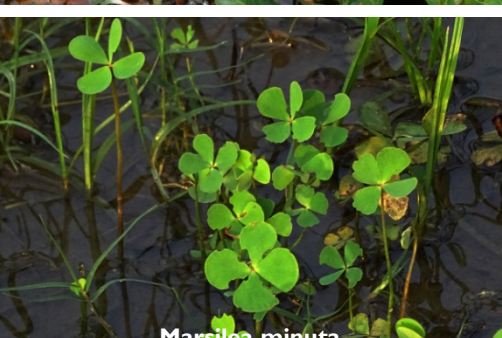
1	1. <i>Victoria amazonica</i>
2	2. <i>Nelumbo nucifera</i>



Ludwigia adscendens



Ludwigia octovalvis



Marsilea minuta



Monochoria vaginalis

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Wetlands are one of the most productive and ecologically sensitive and adaptive ecosystems on earth. Wetlands exhibit enormous diversity on the basis of origin, geographical location, water chemistry, edaphic and sediment features, presence of dominant species and management of water. They support diverse and unique habitats, and provide numerous ecological goods and services. Though many definitions of wetlands exist, there is no single commonly used precise definition of wetlands that is satisfactory to all. The Ramsar international Wetlands Conservation treaty, adopted in 1971, defines wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres". However, the definition of wetlands by Cowardin & al. (1979) is considered to be the popular one, they defined wetlands as "lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water".

Status of Wetlands in India

In India, the wetland habitats are found in various bioclimatic and biogeographic zones; freshwater lakes in the higher elevations of Himalayas, other wetlands and marshy spreads in sub-Himalayan and Gangetic plains, saline and seepage wetlands of arid and semi-arid regions, wetlands of Deccan and coastal regions including islands are the natural wetlands of the country. Besides, there are significantly a large number of man-made wetlands are found in the country. Wetlands occupy 1–5% of total geographical area of the country, and support unique flora and fauna. Among all the states in India, Bihar has maximum geographical area under wetlands followed by Uttar Pradesh whereas Gujarat has the minimum wetland cover.

Diversity of Aquatic and Wetland Plants of India

Christopher D.K. Cook (1996) in his book, "Aquatic and Wetland Plants of India" classified the aquatic and wetland plants of India into nine categories namely (i) Helophytes (terrestrial plants which tolerate submergence), (ii) Haptophytes (plants attached to but not penetrating the substrate), (iii) Tenagophytes (plants in juvenile stage submerged, usually become terrestrial when adult), (iv) Plankton (plants of free-swimming below the water surface), (v) Rosulate (plants submerged, bottom rooted, leaves in a rosette), (vi) Vittate (plants submerged, bottom-rooted, leaves cauline), (vii) Pleustophytes (plants free-floating at the water surface), (viii) Epihydrites (plants bottom-rooted with floating leaves) and (ix) Hyperhydrites (emergent aquatic plants with lower parts almost always in water). However, he has excluded rheophytes, plants those grow on rocks or trees by streams, rivers and waterfalls as well as mangroves and aquatic and wetland plants which occur in the Himalayas but do not extend south to the Indus-Gangetic plain or into Peninsular India from his book. The deltaic regions of India, especially on the east and west coastal regions, support luxuriant growth of estuarine and mangrove vegetation, with unique plant species having various adaptive features to survive in the hostile saline environmental conditions. Apart, mangroves found growing luxuriantly in Andaman and Nicobar Islands. Some of the dominant flowering plants of mangroves of India are: **Acanthus (A. ebracteatus, A. ilicifolius, A. volubilis), Aegiceras (A. corniculatum), Avicennia (A. alba, A. marina, A. officinalis), Brownlowia (B. tersa), Bruguiera (B. cylindrica, B. gymnorhiza, B. parviflora), Ceriops (C. decandra, C. tagal), Excoecaria (E. agallocha, E. indica), Kandelia (K. candel), Lumnitzera (L. littorea, L. racemosa), Rhizophora (R. annamalayana, R. apiculata, R. mucronata, R. stylosa), Sonneratia (S. alba, S. apetala, S. caseolaris, S. griffithii) and Xylocarpus (X. granatum, X. moluccensis, X. rumphii).**

Similarly, there is another curious and unique freshwater swamp forest ecosystem, called "Myristica swamps", as this special ecosystem predominantly consists of arboreal species belonging to the family Myristicaceae, especially species of **Myristica**. "Myristica swamps" found confined to the lower elevations of southern Western Ghats of Kerala and Tamil Nadu, along slow flowing streams.

Alismataceae, Aponogetonaceae, Cabombaceae, Callitrichaceae, Ceratophyllaceae, Cyperaceae, Droseraceae, Elatinaceae, Eriocaulaceae, Hydrocharitaceae, Hydrophyllaceae, Juncaceae, Lemnaceae, Lentibulariaceae, Limnocharitaceae, Menyanthaceae, Najadaceae, Nelumbonaceae, Nymphaeaceae, Poaceae, Podostemaceae, Polygonaceae, Pontederiaceae, Potamogetonaceae, Scrophulariaceae, Trapaceae, Typhaceae, Xyridaceae and Zannichelliaceae are the major flowering plant families in India with many aquatic and wetland plant species. According to Vijayan & al. (2004), a total of 730 species of wetland flowering plants, including 114 endemics are occurring in India. Some of the endemic aquatic flowering plant species are: **Aponogeton appendiculatus, A. bruggenii,**

A. satarensis, Cryptocoryne cognata, C. consobrina, C. spiralis, Lagenandra meeboldii, Eriocaulon breviscapum, E. cuspidatum, E. lanceolatum, E. richardianum, Hydrobryopsis sessilis, Hygrophila serpyllum, Indotristicha ramosissima, I. tirunelveliana, Lemna landoltii, Limnophila glandulifera, L. polystachya, Lindernia minima, Murdannia lanuginosa, M. pauciflora, Myriophyllum oliganthum, Nymphoides macrospermum, Podostemum barberi, Rotala malampuzhensis, R. ritchei, Utricularia cecilia, U. lazulina, Willisia selaginoides, Wiesneria triandra and Zeylanidium maheshwarii.

The wetlands also support pteridophytic flora. Members of Azollaceae, Equisetaceae, Isoetaceae, Marsileaceae, Polypodiaceae, Pteridaceae and Salviniaceae are commonly found in the wetlands of India. **Azolla (A. pinnata** subsp. **asiatica), Isoetes (I. coromandeliana, I. unilocularis), Marselia (M. coromandelina, M. minuta), Microsorium (M. pteropus), Acrostichum (A. aureum), Ceratopteris (C. thalictroides) and Salvinia (S. cucullata, S. molesta)** are some of the Pteridophytes found commonly in the Indian wetlands. In many parts of India, **S. molesta**, the free-floating fern species growing luxuriantly in freshwater ponds and lakes, becomes a very serious threat.

Importance of Wetlands

The human civilisations and wetlands are inseparable. In fact, most of the human civilisations developed around the wetland ecosystems. The economic and cultural activities of humans such as agriculture, fishing, transport, tourism and religious ceremonies are centred on wetlands. The wetlands also play vital role in providing various ecosystem services including carbon sequestration, flood management, soil fertility, and pollution control. Wetlands, the most productive ecosystem, are vital for the sustenance and survival of human beings hence the wetland ecosystems are referred as "kidneys of planet earth". They are also considered as the "cradles of biodiversity" as they support wide array of unique flora and fauna. Realising the importance of wetlands and increasing loss and degradation of wetland habitats, an intergovernmental treaty called the Ramsar Convention was adopted in the Iranian city of Ramsar on 2nd February 1971, and came into force in 1975. Therefore, to remember the date of the adoption of the Convention on Wetlands, the World Wetland Day is being celebrated every year on 2nd February, since 1997. Each year a theme is selected to focus attention to raise awareness among the public about the value of wetlands.

Ramsar Sites in India

To conserve and protect the extant wetland ecosystems in India, the Ministry of Environment, Forest and Climate Change, Government of India has initiated several measures including identification of wetlands across the country for proper management, sustainable development and effective conservation. So far, 27 wetlands (tabulated below) from India have been included in the Ramsar list of wetlands of international importance.

Sl. No.	Name of the Site	State/Union Territory	Area (km ²)	Date of Declaration
1.	Chilka Lake	Odisha	1,165	01.10.1981
2.	Keoladeo National Park	Rajasthan	28.73	01.10.1981
3.	Wular Lake	Jammu and Kashmir	189	23.03.1990
4.	Hariker Lake	Punjab	41	23.03.1990
5.	Loktak Lake	Manipur	266	23.03.1990
6.	Sambhar Lake	Rajasthan	240	23.03.1990
7.	Kanjli	Punjab	1.83	22.01.2002
8.	Ropar	Punjab	13.65	22.01.2002
9.	Ashtamudi Wetland	Kerala	614	19.08.2002
10.	Bhitarkanika Mangroves	Odisha	650	19.08.2002
11.	Bhoj Wetland	Madhya Pradesh	32	19.08.2002
12.	Deepor Beel	Assam	40	19.08.2002
13.	East Calcutta Wetlands	West Bengal	125	19.08.2002
14.	Kolleru Lake	Andhra Pradesh	901	19.08.2002

Sl. No.	Name of the Site	State/Union Territory	Area (km ²)	Date of Declaration
15.	Point Calimere Wildlife and Bird Sanctuary	Tamil Nadu	385	19.08.2002
16.	Pong Dam Lake	Himachal Pradesh	156.62	19.08.2002
17.	Sasthankotta Lake	Kerala	3.73	19.08.2002
18.	Tsomoriri	Ladakh	120	19.08.2002
19.	Vembanad-Kol	Kerala	1,512.5	19.08.2002
20.	Chandertal Wetland	Himachal Pradesh	49	08.11.2005
21.	Hokera Wetland	Jammu and Kashmir	13.75	08.11.2005
22.	Renuka Wetland	Himachal Pradesh	0.2	08.11.2005
23.	Rudrasagar Lake	Tripura	2.4	08.11.2005
24.	Surinsar-Mansar Lake	Jammu and Kashmir	3.5	08.11.2005
25.	Upper Ganga River (Brijghat to Narora Stretch)	Uttar Pradesh	265.9	08.11.2005
26.	Nalsarovar Bird Sanctuary	Gujarat	123	24.09.2012
27.	Sundarban Wetland	West Bengal	4,230	01.02.2019

Threats: As human beings depend on the wetlands for multiple purposes, the wetlands are always subjected to a great anthropogenic pressure all through the human history. As per the 2015 report of Ramsar Convention on Wetlands, the global extent of wetlands is estimated to have declined between 64 and 71% in the 20th century. Therefore, there is a looming threat to the aquatic biodiversity as wetlands continue to decline drastically across the world both in area and quality.

Some of the factors that affect the quality of wetlands that lead to degradation/loss of wetlands in the India are: land filling, siltation, dumping of municipal wastes and various solid wastes; overexploitation (fish and other animal products, plant products); water for irrigation, overgrazing; agricultural practices on the fringes of wetlands; contamination by industrial effluents, domestic sewage, solid wastes and pesticides; invasion of invasive alien species (especially **Eichhornia crassipes, Pistia stratiotes** and **Lemna** species) and tourism beyond carrying capacity. Besides, the lack of awareness on the values of wetlands among the public is considered to be one of the major reasons. According to the study conducted by Vijayan & al. (2004), in India, about 38% of wetlands have been lost in a decade of time, between 1994 and 2004.

Conservation Measures: India should implement strict acts and rules to conserve the extant wetlands of the country; to oversee the legislation a management and monitoring committee has to be established in every state. There should be strict and complete ban on conversion of wetlands into areas of commercial use, dumping of solid wastes and chemical pesticides. Accidental or intentional introduction of invasive alien species in the wetlands should be carefully monitored. It is necessary to prepare the "National Wetland Biodiversity Register", for better understanding on the existing wetland resources, especially the flora and fauna, for sustainable utilisation of resources as well as to effectively design conservation and management strategies to protect and conserve the wetlands and their biodiversity for posterity.



Udhwa lake, Sahibganj, Jharkhand