

Diversity of aquatic Angiosperms and Associated Species of Heranj Wetland, Kheda – Gujarat for Sustainability

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ABSTRACT

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Wetlands are one of the most productive and fertile ecosystems on earth. They cover about 6.4% of the land area of the earth (Mitsch and Gosselink, 1986). Wetlands are tremendously valuable pools of biodiversity and genetic resources, but unsustainable development is intimidating the bio-wealth and even initiating species extinction. Floodplains, mangroves, sea grasses, saltmarshes, arctic wetlands, peat lands, freshwater marshes and forests are very diverse habitats, with different stressors and aquatic angiosperms act as primary creators in aquatic ecosystems and they maintain energy flow in whole bionetwork. Wetland systems are vulnerable to fluctuations in quantity and quality of their water supply, and it is expected that climate change will have a pronounced effect on wetlands through alterations in hydrological regimes with great comprehensive variability. Wetland habitat responses to climate change and the implications for restoration will be realized differently on a regional and mega-watershed level, making it important to recognize that specific restoration and management plans will require examination by habitat. The present study reveals a total of 28 species of Aquatic angiosperms were recorded from the Heranj wetland (Taluka: Matar District: Kheda, Gujarat) that include 8 species of submerged, 2 species of free floating, 5 species of rooted with floating leaves and 13 species of emergent Aquatic angiosperms. *Najas* sp., *Hydrilla* sp., *Typha* sp., *Potamogeton* sp. are dominant species in Freshwater wetland and hence, different management and restoration techniques are needed for its sustainability.

Keywords : Aquatic angiosperms, Heranj pond, Wetland , Ecosystems.

I. INTRODUCTION

Wetlands are one of the most productive and fertile ecosystems on earth. They cover about 6.4% of the

land area of the earth (Mitsch and Gosselink, 1986). In india, wetland also cover 1-5% of the land area(SAC, 2011). Gujarat have both coastal and inland wetland habitat diversity (Stanley, 2004). As per SAC

(2011) Gujarat has total 23,891 wetlands (Both Coastal and Inland wetlands), of which, 9,708 wetlands are those having an area less than 2.25 ha. Total area of these 23,891 wetlands has been estimated at 34,749.50 sq. km which accounts for about 17.56% of geographical area of the State and 22.7% of the total wetland area of the country. The area of the Gujarat State under coastal wetlands (coral reefs, creeks, inter-tidal flats, sand/beach, coastal marsh mangroves, etc.) are approximately 28,071 sq. km and that under inland wetlands (ponds, rivers, tanks, streams, oxbow lake) has been approximately 6,582 sq. km.

The present study of inland wetland has been carried out for knowing the diversity of the aquatic angiosperms and Associated Species of Heranj wetlands of Gujarat. This is a man-made wetland having an Open Water, emergent hydrophytic vegetation growth, water with *Nymphaea/Nelumbo* cover, water with decomposing submerged vegetation mat as the predominant habitat component within it.

II. STUDY AREA

The study covered one Prioritized wetlands sites from Central Gujarat, Viz., Heranj Wetland. Heranj wetland is located in Matar taluka at 22°40'9.7"N latitudes and 72°41'28.5"E longitudes. It is situated at the distance of just 27 km north of Tarapur on Tarapur-Kheda State highway, 50 km from Ahmedabad and 50 km from Khambhat . The big lake of heranj is approximately kms. in area with depth varying between 2 ft to 10 ft.

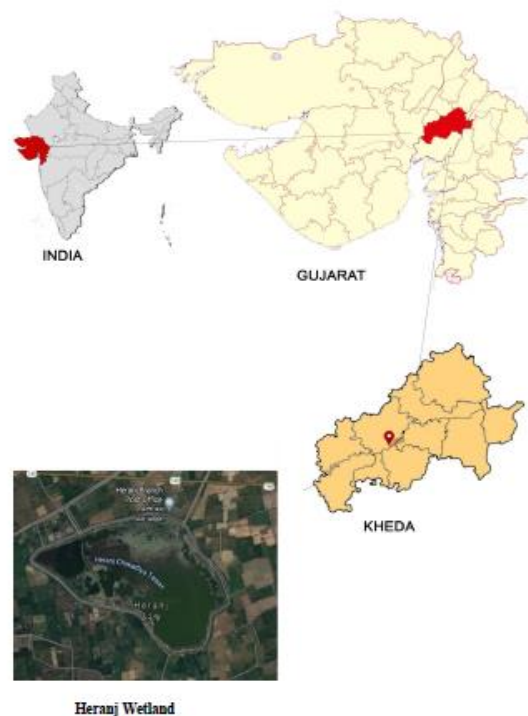


Figure 1: Satellite image of Heranj Wetland (Source: Google Map)

III. METHODS AND MATERIAL

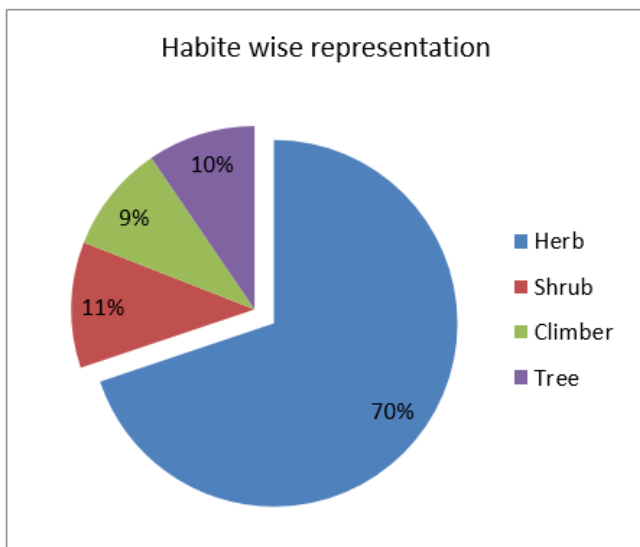
The field survey was started with a reconnaissance survey of Heranj Wetland located at Khambhat District of Gujarat state, India. Further, data collection was carried out in each of the season i.e., Summer, Monsoon and Winter. For flora study, a Belt- Transect with stratified random sampling method were carried out. The entire area of wetlands was covered by satisfied sampling and belt transect. The transects were decided and marked in such a way that each transect would represent a type of habitat. The data of flowering plants collected in each season from selected transect-based for habitat stratification. Heranj wetland endowed with six habitat components, i.e. inlet, outlet, open water, emergent hydrophytic vegetation growth, water with *Nymphaea/Nelumbo* cover, water with decomposing submerged vegetation mat. The plants were identified

with the help of standard literature and based on micro-morphological plants Characters and flowers.

IV. RESULTS AND DISCUSSION

Qualitative analysis

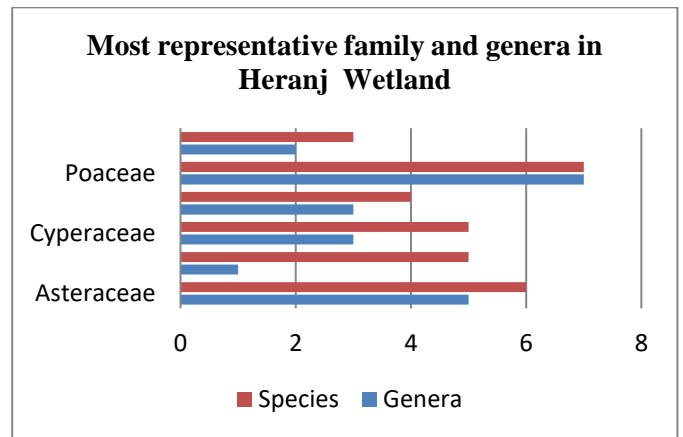
During the present study, a total of 63 species belonging to 32 families and 53 genera of flowering plants have been recorded from the in and around the Heranj wetland. Dicots represented by 40 species belong to 33 genera and 23 families while Monocots represented by 23 species belongs to 20 genera and 9 families. **Graph 1** showed habit wise analysis of plants i.e., tree, shrubs, climber, herbs, etc. Furthermore, plant checklist was prepared based on the visual observation in the quadrats as well transects (**Table 3**).



Out of 32 families, 47 genera are represented by single species of each genus. Asteraceae is largest families among the dicot while Poaceae and Cyperaceae are largest among the monocots which are poorly represented. A total of 63 species of flowering plants, 44 species are herbs, 7 species are shrubs, 6 species are climbers and 6 species are trees. This study show that herbaceous plants are dominating in the wetland and its surrounding areas.

Most representative family and genera in Heranj Wetland

Most representative family, genera and species of Heranj are Poaceae (7 species), followed by Asteraceae (6 species), Cyperaceae (5 species), Convolvulaceae (5 species), Convolvulaceae (5 species) etc. as given in graph 2.



Aquatic Angiosperms

The Angiosperms are classified into submerged, free floating, rooted floating and emergent vegetation. Total 28 species recorded under this study belonged to 15 families. Majority of the species are recorded from emergent (13 species) vegetation followed by submerged (8 species), Rooted floating (5 species) and Free floating (2 species) Vegetation, etc. (**graph 3**)

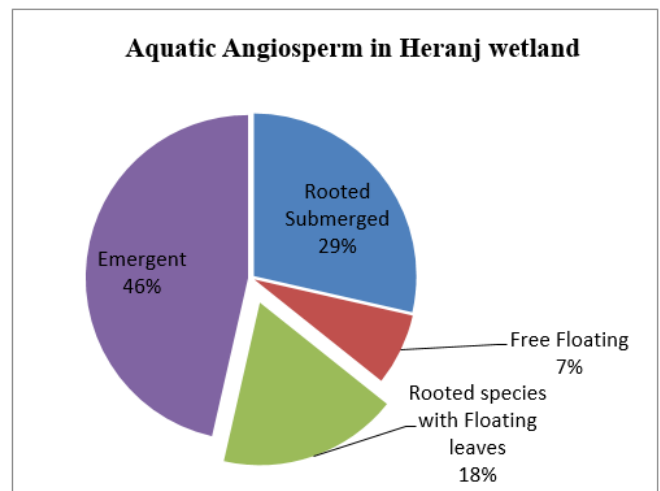


Table 1: List of Aquatic Angiosperms at Heranj Wetland

Sr. No.	Botanical Name	Family	Status	Habit	Indicator status
1	<i>Ammannia baccifera</i> L.	Lythraceae	Emergent	Herb	FAC
2	<i>Cyperus difformis</i> L.	Cyperaceae	Emergent	Herb	FACW
3	<i>Cyperus iria</i> L.	Cyperaceae	Emergent	Herb	FACW
4	<i>Cyperus rotundus</i> L.	Cyperaceae	Emergent	Herb	FACW
5	<i>Cyperus bulbosus</i> Vahl	Cyperaceae	Emergent	Herb	FACW
6	<i>Eichhornia crassipes</i> (Mart.) Solms	Pontederiaceae	Free Floating	Herb	OBL
7	<i>Fimbristylis aestivalis</i> Vahl	Cyperaceae	Emergent	Herb	FACW
8	<i>Hydrilla verticillata</i> (L.f.) Royle	Hydrocharitaceae	Submerged	Herb	OBL
9	<i>Hygrophila auriculata</i> (Schum.) Heine	Acanthaceae	Emergent	Herb	FACW
10	<i>Ipomoea aquatica</i> Forssk.	Convolvulaceae	Rooted Floating	Climber	FACW
11	<i>Ipomoea carnea</i> Jacq.	Convolvulaceae	Emergent	Climber	FACW
12	<i>Ipomoea marginata</i> (Desr.) Verdc.	Convolvulaceae	Rooted Floating	Climber	FACW
13	<i>Ipomoea triloba</i> L.	Convolvulaceae	Rooted Floating	Climber	FACW
14	<i>Lemna minor</i> L.	Lemnaceae	Free Floating	Herb	OBL
15	<i>Limnophyton obtusifolium</i> (L.) Miq.	Alismataceae	Emergent	Herb	FACW
16	<i>Ludwigia adscendens</i> (L.) Hara	Onagraceae	Emergent	Herb	FACW
17	<i>Najas marina</i> L.	Hydrocharitaceae	Submerged	Herb	OBL
18	<i>Najas minor</i> All.	Hydrocharitaceae	Submerged	Herb	OBL
19	<i>Nelumbo nucifera</i> Gaertn.	Nelumbonaceae	Rooted Floating	Herb	OBL
20	<i>Nymphaea nouchali</i> Burm.f.	Nymphaeaceae	Rooted Floating	Herb	OBL
21	<i>Persicaria glabra</i> (Willd.) M.Gómez	Polygonaceae	Emergent	Herb	FACW
22	<i>Potamogeton crispus</i> L.	Potamogetonaceae	Submerged	Herb	OBL
23	<i>Potamogeton nodosus</i> Poir.	Potamogetonaceae	Submerged	Herb	OBL
24	<i>Scirpus littoralis</i> Schrad.	Cyperaceae	Emergent	Herb	FACW
25	<i>Stuckenia pectinata</i> (L.)	Potamogetonaceae	Submerged	Herb	OBL

	Börner				
26	<i>Typha angustifolia</i> L.	Typhaceae	Emergent	Herb	FACW
27	<i>Utricularia inflexa</i> Forssk.	Lentibulariaceae	Submerged	Herb	OBL
28	<i>Vallisneria spiralis</i> L.	Hydrocharitaceae	Submerged	Herb	OBL

(* Obligate Wetland Plants (OBL), Facultative Wetland Plants (FACW), Facultative Plants(FAC), Facultative Upland Plants (FACU), Obligate Upland Plants (UPL)).

During fieldwork at Heranj wetland 28 species of aquatic macrophytes were identified and listed based on the visual observation in the quadrats as well transects by using Cook (1996) and Shah (1978). The given table show list of aquatic macrophytes with their indicator statuses, habit, family, class etc.(Table:1)

Wetland indicator status

The National List of Plant Species that Occur in Wetlands is a list of wetland plants and their assigned indicator statuses. The five indicator statuses are: Obligate Wetland Plants (OBL), Facultative Wetland Plants (FACW), Facultative Plants (FAC), Facultative Upland Plants (FACU), Obligate Upland Plants (UPL). Based on these indicator statuses total of 63 species of plants were categories and represented. Out of these 31 species belong to Obligate Upland Plants, 15 Facultative Wetland Plants, 12 Obligate Wetland Plants, 5 Facultative Upland Plants and 1 naturalized, 1 Facultative Plants. (Graph 4.)

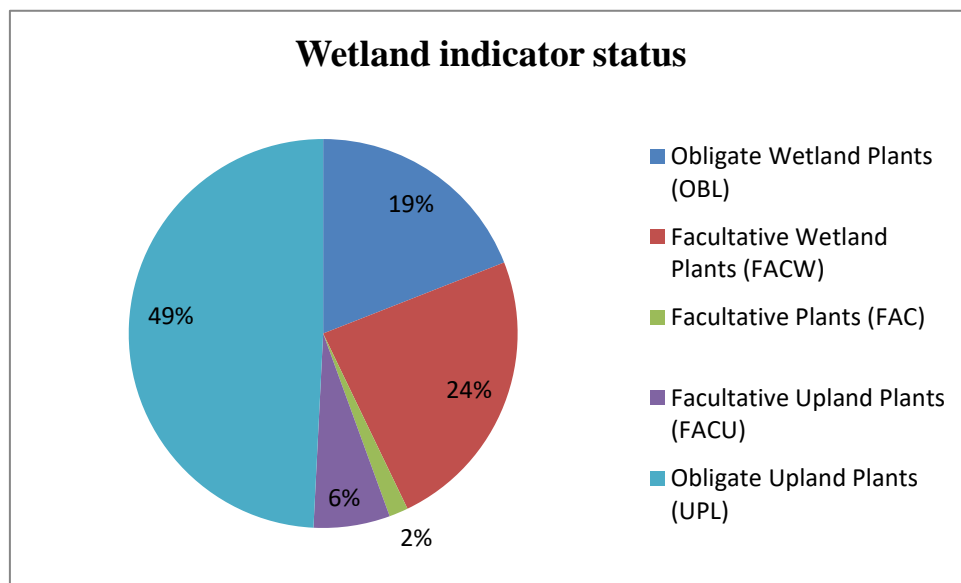


Table 2. Role of Species involved in wetland Sustainability:

Sr. No	Species	Role	References
1	<i>Hydrilla verticillata</i>	Cleaning of wetland water	Toth & Anderson., 1998
		Helps in Phosphorus removal	Gu., 2006.
2	<i>Ipomoea aquatica</i>	Bio-accumulation lead, cadmium and arsenic	(Ghosh, 2010)
3	<i>Eichhornia crassipes</i> and <i>Hydrilla verticillata</i>	Phosphorus removal efficiency	Shardendu <i>et al.</i> , 2012.
4	<i>Phragmites</i> sp. and <i>Typha</i> sp.	Sequential nitrogen detoxification, removal of BOD and TSS of	Brix,1997
5	<i>Scirpus</i> Sp.	Removing ammonia	Brix,1997
6	<i>Typha</i>	Accumulation of phosphorous	Brix,1997
7	<i>Eleocharis</i> spp, <i>Nymphaea odorata</i>	Increases nitrogen content	Zweig et al 2008

Table 3 : Check list of flowering plants of Heranj Wetland

Sr. No.	Botanical Name	Local name	Family	Habit
1	<i>Abutilon indicum</i> (L.) Sw.	Mudra, Petari, Karandi	Malvaceae	Shrub
2	<i>Achyranthes aspera</i> L.	Andhedi	Amaranthaceae	Herb
3	<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	-	Amaranthaceae	Herb
4	<i>Ammannia baccifera</i> L.	Jal agiyo	Lythraceae	Herb
5	<i>Azadirachta indica</i> (L.) Juss.	Neem, Limdo	Meliaceae	Tree
6	<i>Blumea lacera</i> (Burm.f.) DC.	-	Asteraceae	Herb
7	<i>Blumea mollis</i> (D. Don) Merr.	-	Asteraceae	Herb
8	<i>Calotropis procera</i> (Aiton) Dryand.	Akado	Asclepiadaceae	Shrub
9	<i>Chloris barbata</i> Sw.	-	Poaceae	Herb
10	<i>Cocculus hirsutus</i> (L.) W.Theob.	Vevdi	Menispermaceae	Climber
11	<i>Coix lacryma-jobi</i> L.	-	Poaceae	Herb
12	<i>Commelina benghalensis</i> L	-	Commelinaceae	Herb
13	<i>Cyanthillium cinereum</i> (L.) H.Rob.	-	Asteraceae	Herb

14	<i>Cynodon dactylon</i> (L.) Pers.	Darbh	Poaceae	Herb
15	<i>Cyperus difformis</i> L.	-	Cyperaceae	Herb
16	<i>Cyperus iria</i> L.	-	Cyperaceae	Herb
17	<i>Cyperus rotundus</i> L.	Dilo	Cyperaceae	Herb
18	<i>Dichanthium annulatum</i> (Forssk.) Stapf	Darbha	Poaceae	Herb
19	<i>Digitaria abludens</i> (Roem. & Schult.) Veldkamp	Bondya	Poaceae	Herb
20	<i>Eclipta prostrata</i> (L.) L.	-	Asteraceae	Herb
21	<i>Eichhornia crassipes</i> (Mart.) Solms	-	Pontederiaceae	Herb
22	<i>Eragrostis tenella</i> (L.) P. Beauv.	-	Poaceae	Herb
23	<i>Euphorbia hirta</i> L.	-	Euphorbiaceae	Herb
24	<i>Ficus virens</i> Dryand. ex Ait.	-	Moraceae	Tree
25	<i>Fimbristylis aestivalis</i> Vahl	-	Cyperaceae	Herb
26	<i>Glinus lotoides</i> L.	-	Molluginaceae	Herb
27	<i>Grangea maderaspatana</i> (L.) Poir.	-	Asteraceae	Herb
28	<i>Heliotropium supinum</i> L.	Prostrate Heliotrope	<u>Boraginaceae</u>	Herb
29	<i>Hydrilla verticillata</i> (L.f.) Royle	-	Hydrocharitaceae	Herb
30	<i>Hygrophila auriculata</i> (Schum.) Heine	-	Acanthaceae	Herb
31	<i>Ipomoea aquatica</i> Forssk.	Vel	Convolvulaceae	Climber
32	<i>Ipomoea carnea</i> Jacq.	Bush Morning Glory	Convolvulaceae	Climber
33	<i>Ipomoea marginata</i> (Desr.) Verdc.	-	Convolvulaceae	Climber
34	<i>Ipomoea pes-tigridis</i> L.	-	Convolvulaceae	Climber
35	<i>Ipomoea triloba</i> L.	-	Convolvulaceae	Climber
36	<i>Lantana camara</i> L.	-	Verbenaceae	Shrub
37	<i>Launaea procumbens</i> (Roxb.) Ramayya & Rajagopal	Gadjepi	Asteraceae	Herb
38	<i>Lawsonia inermis</i> L.	Mahendi	Lythraceae	Shrub
39	<i>Lemna minor</i> L.	-	Lemnaceae	Herb
40	<i>Limnophyton obtusifolium</i> (L.) Miq.	-	Alismataceae	Herb
41	<i>Ludwigia adscendens</i> (L.) Hara	-	Onagraceae	Herb
42	<i>Mangifera indica</i> L.	Ambo	Anacardiaceae	Tree
43	<i>Najas marina</i> L.	-	Hydrocharitaceae	Herb
44	<i>Nelumbo nucifera</i> Gaertn.	Kamal	Nelumbonaceae	Herb
45	<i>Nymphaea nouchali</i> Burm.f.	Poynu	Nymphaeaceae	Herb
46	<i>Polygonum plebeium</i> R.Br.	-	Polygonaceae	Herb
47	<i>Potamogeton crispus</i> L.	-	Potamogetonaceae	Herb
48	<i>Potamogeton nodosus</i> Poir.	-	Potamogetonaceae	Herb

49	<i>Prosopis cineraria</i> (L.) Druce	Khijdo	Leguminosae	Tree
50	<i>Prosopis juliflora</i> (Sw.) DC.	Gando Baval	Leguminosae	Shrub
51	<i>Rungia repens</i> (L.) Nees	-	Acanthaceae	Herb
52	<i>Salvadora persica</i> L.	Piludi	Salvadoraceae	Shrub
53	<i>Scirpus littoralis</i> Schrad.	-	Cyperaceae	Herb
54	<i>Senna auriculata</i> (L.) Roxb.	Tarvad, Awal	Leguminosae	Tree
55	<i>Sida cordifolia</i> L.	-	Malvaceae	Herb
56	<i>Solanum surattense</i> Burm. f.	Boyringni	Solanaceae	Herb
57	<i>Sporobolus coromandelianus</i> (Retz.) Kunth	-	Poaceae	Herb
58	<i>Stuckenia pectinata</i> (L.) Börner	-	Potamogetonaceae	Herb
59	<i>Typha domingensis</i> Pers.	Gha Bajariu	Typhaceae	Herb
60	<i>Vachellia nilotica</i> (L.) P.J.H. Hurter & Mabb.	Baval	Leguminosae	Herb
61	<i>Vallisneria spiralis</i> L.	-	Hydrocharitaceae	Herb
62	<i>Ziziphus jujuba</i> Mill.	Bor	Rhamnaceae	Tree
63	<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn	Chani-Bor	Rhamnaceae	Shrub

V. CONCLUSION

Anthropogenic activities have impacted on wetland ecosystem services across the world. Restoration of wetlands are needed. Present study show the species composition of aquatic angiosperm are play vital role for wetland sustainability as well as it can be consider throughout the wetland restoration activity. Study will also helpful to recreate wetland diversity precisely to Kheda District which have maximum number of wetland in Gujarat state. Furthermore, study can be also helpful for understanding the complexity of wetland ecosystem.

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