2

Natural Resources and their attributes

2.1 Location and Boundaries

Thol Sanctuary is located about 25 km northwest of Ahmedabad between 23^0 15' to 23^0 30' N. and 72o 30' to 72 45' E. It is 22 km away from the town of Kadi in district Mehsana.

The legal boundary notification is as follows :

North : Radar Station of Air Force at Village Hajipura, survey nos. 1004, 1006, 8, 7, 9, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78

East : O.N.G.C. Buildings, Jethalajpur and Jethalaj village Survey nos. 615, 35, 36, 46, 1, 2, 48

South : Jethalaj village Survey nos. 451, 459, 410, 461, 462, 1, 2, 463, 491, 1, 495, 49, 2, 500, 1, 2, 3, 499, 1, 2, 508, 509, 510, 1, 2, 512, 513, 1, 2, 514, 526, 531, 533, 534, 537, 1, 2, 3, 538, 539, 540, 541, 542, 1, 2, 543, 544, village forest 385/1.

West : Nasmed village Survey nos. 49, 2, 50, 51, 70, 1, 2, 71, 1, 2, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 1, 2, 83, 84, 85, 86, 1, 2, 93, 94, 95, 96, 97, 99.

2.2. Approach and Access

The nearest city is Ahmedabad, about 25 Kms. The sanctuary is connected by air and railway. Nearest towns are Kadi and Sanand which are Taluka Head Quarters too. The sanctuary is connected through road by State Highway from Sanand-Kadi. State Transport bus services are available, connecting Thol to different locations. Telephone and Post Office facilities are available at Thol village which is just 2 kms away.

2.3. Biodiversity

Thol sanctuary is an important Inland Wetland. The pond and the surroundings area provide excellent habitat to the waterfowl during post monsoon to winter season. 92 Bird Species are reported here. It is a potential Ramsar site as it supports more than 20,000 waterfowl. 15 bird species which are reported here are identified as rare, vulnerable, threatened or endangered globally by various agencies worldwide.

Thol Wildlife Sanctuary (hereinafter mentioned as TWS) also is an important focal wetland for pre-breeding congregation of the Sarus Crane (*Grus antigone*) as well as for its nesting. TWS has got a unique distinction of having one of the highest congregations of Ruffs (*Philomachus pugnax*) in India.

2.3.1 Flora

Emergent and floating aquatic plants are there at Thol Wildlife Sanctuary along with some terrestrial trees and herbs such as *desi baval, bor, neem, vad, pilu, gando baval, kerdo* etc.

2.3.2 Fauna

High species diversity of water birds is the main attraction for an eco-tourist.

List of Important Mammals found in TWS

Scientific name	English name	Local name
Flying Mammals		
Pteropus giganteus	Indian Fruit Bat	Chamachidiyu
Pipistrellus coromandra	Indian Pipistrelle	-
Large Mammals		
Presbytis entellus	Hanuman Langur	Bander
Canis aureus	Jackal	Shiyal
Baselaphus tragocamelus	Blue bull	Nilgai
Small Mammals		
Suncus murinus	Musk Shrew	Chhachhunder
Herpetes edwardsi	Common Mongoose	Noliyo
Paraechinus misfopus	Pale Hedgehog	Shelo
Felis Chaus	Jungle Cat	Jangali Biladi
Lepus nigricollis	Indian Hare	Sasalu
Sus scrofa	Feral Pig	Jungli Bhund

Important birds: Bird communities are often referred as an ideal indicator to monitor the ecological condition of any wetlands as they impact on all the tropic levels of an aquatic ecosystem. On the other hand aquatic ecosystems have significant impact on migratory birds. Birds are the best studied class of organism and various investigations have established their significance as important mobile links (active movement and connect habitats in space and time) in the dynamics of natural and human dominated ecosystems. Birds are one of the diverse ranges of ecological functions among vertebrates. As consumers, they help regulate populations of smaller animals they prey upon, disperse plant seeds, and pollinate flowering plants. Cranes, geese, flamingos, pelicans, egrets, herons, spoonbills, ducks, whistling teals etc. are some of the wetland birds.

Thol Wetlands being fresh water ecosystem are dominated by birds. The birds will be on the highest tropic level. Thol water body has two flagship species such as Sarus Crane (*Grus antigone*) and Osprey (*Pandion haliaetus*) since they represent the present ecosystem which is in need of conservation. They are distinctive in order to engender

support and acknowledgement from the public. It can be appreciated from records that large number of Sarus congregations were seen. It has presence of over 50 birds' which were often seen feeding in the farmlands neighbouring Thol; bird has remained the integral part of this territory (Singh & Tatu, 2000).

Sarus Crane (*Grus antigone*)

Sarus Crane is a large crane that is a resident breeding bird with *disjunct* populations that are found in parts of the Indian Subcontinent, Southeast Asia and Australia. Having height up to 1.8m, it is tallest of the flying birds; they are conspicuous and iconic species of open marshlands. As a species, the Sarus crane is classified as vulnerable this means that the global population has declined by about a third since 1980, and is expected to continue to do so until the late 2010s.

Estimates of the global population suggest that the population in 2000 was at best about 10% and at the worst just 2.5% of the numbers that existed in 1850. Unlike many cranes which make long migrations, the Sarus Crane does not; they may however make short-distance dispersal movements.

Invertebrates: - In freshwater sediments, benthic invertebrates are diverse and abundant, but they are often patchily distributed and relatively difficult to sample, especially when they live in deep subsurface sediments. Therefore, benthos can give us reliable information on stream and lake water quality. Their long life cycles allow studies conducted by aquatic ecologists to determine any decline in environmental quality. Benthos represents an extremely diverse group of aquatic animals, and the large number of species possesses a wide range of responses to stressors such as organic pollutants, sediments, and toxicants. Many benthic macro invertebrates are But there is insufficient information about how individual zoo benthic species interact with one another under the dynamic range of natural conditions in freshwater sediments. The spatial and temporal distributions suggest that benthic species have different preferences for particular ranges of temperature, pH, current velocity, and types of substrata. Colonization suggests that there are important differences which preferred us of microhabitats. Thol Wetlands had presence of 10 species of macro fauna within sanctuary and among them the dominating was *Chironomous* larvae and site 6 had abundance. Chironomidae members are also broadly dispersed and often the most abundant insect species in freshwater ecosystems (Pinder, 1986). Their ecological diversity is proved by their physiological tolerance to environmental stress, such as modifications of salinity or temperature and reduced levels of dissolved oxygen

(Rasmussen, 1984). The larvae are an important food item for fish such as trout, amphibians and insectivorous birds such as swallows and martins. These groups of birds are present in the study area, indicating the species importance in Thol wetland As no study is carried out on micro and macro invertebrates detailed information is not available. Some zooplanktons found in the study by GEER Foundation team are as follows :

Phylum : Protozoa

1. Volvox Spp.
2. Ophryoglenu spp.
3. Amoeboid froms.

Phylum : Rotifera

4. Platyias spp.
5. Hydra – egg.

Phylum : Arthropoda

6. Daphnia spp.
7. Cyclops spp.
8. Cypris spp.
9. Beetle - nymph

Vertebrates :- Although this is a more visible group, available information on vertebrates of TWS is sketchy. The GEER Foundation team observed following animals.

Fishes : Four species of fish have been reported from TWS (Vaghela 1993.) These have been listed below :

1. Ophiocephalus punctatus
2. Heteropheustes fossillis
3. Chela bucaila
4. Barbus stigma

Surprisingly, common species of carps such as Mrigal, Rohu and Catla found in most freshwater reservoirs have not been recorded. The District Gazetteer has recorded eight species of fish in Mehsana (Rajyagor 1975). These are Padi, Nagra, Marel, Kar, Bam, Singie, Dhebar, Supta and Chall (all local names). Ichthyologic studies at Thol Wildlife Sanctuary listed 19 species of fish (Anon. 1998) It is felt that a detailed documentation of the fish fauna of TWS is needed.

Amphibians: Bull frog (*Hoplobatrachus tigerinus*), Marbled Toad (*Bufo stomaticus*).

Reptiles: Rat snake (*Ptyas mucosus*), Cobra (*Naja naja*), Garden Lizard (*Calotes versicolor*), Bengal Monitor (*Varanus bengalensis*), Indian Flapshell Turtle (*Lissemys punctata*).

Mammals: Eight species of mammals have been listed by (Rajyagor 1975) such as Common Langur *(Presbytis entellus)*, Jungle Cat *(Felis chaus)*, Common Mongoose *(Herpestes edwardsi),* Jackal *(Canis aureus)*, Pale Hedgehog *(Parachinus micropus)*, Grey Mask Shrew *(Suncus murinus)*, Indian Flying fox *(Pteropus giganteus) and* Nilgai *(Boselaphus tragocamelus)*.

2.4. Ground water recharge

Thol Wetlands play a critical role in regulating the movement of water. Thol Wetlands store precipitation and surface water and then slowly release the water into associated surface water resources, ground water, and the atmosphere. It helps to maintain the level of the water table and exert control on the hydraulic head. It provides a force for ground water recharge and discharge to other waters as well. The soil, vegetation of the site, perimeter to volume ratio, and water table gradient of Thol acts to support the nearby aquifers. Researchers have discovered ground water recharge of up to 20% of wetland volume per season (Weller 1981). Ground water is vital resources for a region like Mehsana where agriculture, domestic water supply and industry are highly dependent on it. It is also single largest and most productive source of irrigation water and plays a critical role in maintaining agricultural production during droughts. Due to fast urbanization and reduction of agricultural zone, which could have acted as the percolation zone, the replenishing of this ground water is getting difficult and the consequence of which is evident as the scarcity of water. Floodplains in the Sanctuary recharge the ground water.

2.4.1. Geology and Water Quality.

Geologically it is a part of the alluvial plain of recent age. The soil is clayey to sandy clay. There are no hard rock outcrops in and around the sanctuary. The highest average depth of water is 3.04 meter and lowest water depth is 0.60 metre.

2.4.2. Analyses of the Water Quality

Wetland ecosystem is a very queer and delicate balanced system. During the last three or four decades, wetlands throughout the world, in the developed countries, have exhibited an increasing enrichment or eutrophication brought about by man's direct or indirect

influence. They are mainly in the form of excessive dumping of nutrients from varying sources in the form of domestic or industrial effluents, agricultural runoff etc. Which in turn definitely affect the biotic and abiotic facts of the aquatic bodies (Jindal, 2008). It is imperative to maintain the productive and protective role of wetlands in perpetuity. Not much information is available regarding the water quality of this wetland. There is a possibility that over the year's water is supplied with more of Nitrogen and Phosphate nutrients and one species covers the wetland leading to the problem of eutrophication, this disturbs the ecosystem balance which could influence the depending biodiversity of the area. The attempt made in these regards in this study had assessed different water quality parameters like pH, Electrical Conductivity, Alkalinity, Acidity, Total Solids, Total Dissolved Solids, Total Suspended solids, Organic Matter, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Nitrogen, Phosphates, Phenols & Heavy Metals in various locations within the sanctuary boundary.

2.5. Economical value

Thol Wetlands contribute to the local economy by producing resources, enabling recreational activities and providing other benefits, such as pollution control and flood protection. While it can be difficult to calculate the economic value provided by this wetland. These amounts can be impressive.

2.6. Irrigation

Ironically although Thol is a wetland with a great water spread, it is located in an arid region. The area receives very less mudflat- the average being only 24 inches or 600 mm. The water spread decreases considerably during the summer season. It is the time, when the villagers around Thol also have to face acute scarcity of water, both for drinking and agriculture. The villagers, therefore, resort to lifting of water from Thol during the summers and in the scarcity years throughout the years. This activity may render the wild creatures inhabiting Thol virtually, devoid of their valuable lifeline- water. There are total 15,499.48 ha. of agriculture land in 10 surrounding villages which depend upon Thol for irrigation.

2.7. Grazing

The villagers from the nearby areas of the Sanctuary are dependent on it for livestock grazing, wood and grass extraction. A large number of livestock especially goats, buffaloes and cows exclusively depend and get their fodder from the floodplain areas in and around the sanctuary for seven months in the year when the flooding water recedes. Different plant species, which grow in the Sanctuary like, Saccharum sp., Typha species, are used by the local peoples for various purposes.

2.8. Climate

Thol area experiences three distinct seasons namely winter (November to February), summer (April to May) and monsoon (June to September). Months of October and March mark the transition period from monsoon to winter and winter to summer respectively. The pond receives rainfall from July to September through the southwest monsoon. Old records for Mehsana district in general (Anno., 1975), as well as rainfall data of previous years at TS indicate that the rainfall is highly erratic and ranges from 203 to 786 mm.

2.9. Hydrological Features

Thol water body occupy total area of 699 ha (6.99 sq.km.) and its periphery is 5.62 km long. Thol wetland provides water for agriculture to the six villages i.e. Thol, Jethlaj, Adhana, Vayana, Chandanpura, Jhaloda which spreads 55.95 sq.km. It had well-developed canal based irrigation system, there are four head regulators at the water body to control the flow of water.

Table 5: - Details of the irrigation canals of Thol water body

Sr No.	Canal No./ Distributory	Length (km)	Command Area (Acres)	Discharge (CUSECS)
1	Canal 2	2.56	360	9.00
2	Canal 3	4.10	435	11.00
3	Canal 4	6.70	300	26.00
4	Distributary (Distri.) 1 of Canal 4	0.80	100	2.80
5	Sub-Distri. Of Distri.1	0.65	200	2.80
6	Distri. 2 of Canal 4	2.52	200	10.00
7	Distri. 3 of Canal 4	2.64	285	12.00
	Total	**19.97**	**1780**	-

The canals and their distributaries / sub-distributaries are about 19.97 km long The catchment area of the water body which covers 320 sq. km is located to its north and north-east so the spread is from Kadi taluka of Mehsana district and Kalol taluka of Gandhinagar district. Water finds its way through a number of canals draining into the feeder canal located on the north to northeastern sides of the water body. Water is received through following canals at Thol water body

1. Eastern canal
2. Saij-Hajipur canal
3. Irana-Indrad- Wamaj canal
4. Hajipur-Piyaj canal
5. Eastern feeder at Saghan drain
6. Jaspur canal

In addition to the feeder canal, the water body receives run-off water directly from the catchment area. Before the feeder canal reaches the manmade wetland, there is a diversion, which is known as waste weir and is employed to control the volume of water in the water body. If the level of water reaches beyond 9 ft., the water is diverted to waste weir. Waste weir drains into a canal, which runs along the eastern boundary of the Thol pond/tank to reach Thol Wildlife Sanctuary located southwest of Thol Wildlife Sanctuary. Thol and Thol Wildlife Sanctuary are thus connected with each other. Some salient features of the water body have been highlighted in table below

Table Salient Features of Thol

Sr. No.	Particulars	Measure
1	Full Supply Level (FSL)	163 ft.
2	High Flood Level (HFL)	167 ft.
3	Top of the bank	172 ft.
4	By-pass level	165 ft.
5	Sill level	153 ft.
6	Catchment area	320 sq. km
7	Storage capacity	312 Million Cubic ft.
8	Total command Area	3,670 acres
9	Irrigation Command Area	1,835 acres
10	Area of the tank	1728.31 acres
11	Area under submergence at FSL	1780 acres